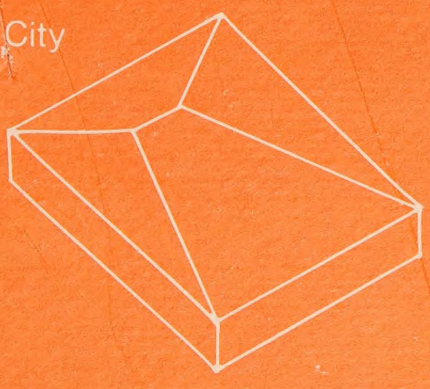
SOLAR ENVELOPE ZONING

Application to the City planning process



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SOLAR ENVELOPE ZONING: APPLICATION TO THE CITY PLANNING PROCESS LOS ANGELES CASE STUDY

JUNE 1980

PREPARED BY THE CITY OF LOS ANGELES
THROUGH PARTICIPATING CITY DEPARTMENTS:

MAYOR'S OFFICE
DEPARTMENT OF CITY PLANNING
CITY ATTORNEY'S OFFICE

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SERI TECHNICAL MONITOR:

PETER POLLOCK

TOM BRADLEY, mayor

LOS ANGELES CITY COUNCIL

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DEPARTMENT OF CITY PLANNING

Calvin S. Hamilton

FOREWORD

Solar envelope zoning represents a promising approach to solar access protection. A solar envelope defines the volume within which a building will not shade adjacent lots or buildings. Other solar access protection techniques, such as privately negotiated easements, continue to be tested and implemented but none offer the degree of comprehensiveness evident in this approach. Easements rely on agreements between individual landowners while the solar envelope system is applied within an entire zoning district. Also, easements probably would not be negotiated until a solar system is planned or installed; the envelope approach protects access for new development so that it can benefit from a future solar installation. In this way, maximum flexibility is ensured; a quality especially important with a rapidly changing technology.

The Community and Consumer Branch of the Solar Energy Research Institute is interested in solar envelope zoning and is continuing funding to resolve the multitude of issues that arise with this new concept of zoning and property law.

In a previous report (Solar Envelope Concepts: Moderate Density Building Applications, April 1980, SERI/SP-98155-1), Professors Knowles and Berry and their students at the School of Architecture, University of Southern California, addressed several issues related to the trade-off between development potential and solar access protection for moderate density commercial and residential development. Their results were very encouraging. In a variety of case study designs for commercial office buildings in Los Angeles, floor area ratios of 2.25 to 4.73 were achieved. For moderate-density housing, averaging results from six different sites, a density of 52 dwelling units per acre was achieved. These findings clearly indicate that urban densities and solar envelope zoning are compatible.

In this report, the City of Los Angeles, through the Mayor's Energy Office, the City Planning Department, and the City Attorney's Office, examine the feasibility of translating the concept of solar envelopes into zoning techniques. They concluded that envelope zoning is a fair and consistent method of guaranteeing solar access, but problems of complexity and uncertainty may limit its usefulness. Envelope zoning may be inappropriate for the development of high density "centers" and for more restrictive community plans. Aids or tools to administer envelope zoning need to be developed. Finally, some combination of approaches, including publicly recorded easements, subdivision approval and envelope zoning, need to be adopted to encourage solar use in cities.

SERI has developed a work program with the University of Southern California to continue study of the solar envelope concept, concentrating on the application of the solar envelope to a high-density urban redevelopment project and also to the infill of housing on sloping sites.

These studies mark a beginning in the effort to introduce solar energy technologies in crowded urban environments where the bulk of U.S. population resides. Solar access protection is a necessary condition for the widespread use of solar energy in cities. We hope that the results of this research project and others to come will help address some of the concerns regarding development potential and solar access protection, and will ultimately help cities achieve a higher degree of energy self sufficiency.

Robert Odland

Robert Odland, Branch Chief

Peter Pollock

Peter Pollock, Staff Urban Planner

Community and Consumer Branch
Solar Energy Research Institute
Golden, Colorado

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INTRODUCTION

Since April 1976, when Mayor Bradley announced his "Solar City Program" for Los Angeles, considerable attention has been given to various aspects of a property owner's "right to sunshine." The desire to expand solar heating for residential and other structural heating, and for heating domestic water and industrial (process) water has demanded not only a clarification and specificity in the matter of solar access, but a means of protection which is not present in the existing planning and regulating tools of the City. The California Energy Commission reports that in 1978 there were an estimated 8,000 solar unit starts and the State's Solar Industry doubled its output over 1977 to $75-100 million. The Industry estimates that business will be in the 4-7 billion dollar range in California by the late 1980's. The California Solar Energy Industries Association estimates that 40,000 to 50,000 new solar systems were installed in 1979. The California Energy Commission further estimates that 80% or more of the total housing starts by the year 2000 could contain passive or active solar features.

One method of protecting solar access is to enforce a type of zoning called the solar envelope zone. The solar envelope can be defined as the largest volumetric container over a land parcel that allows solar access to all adjacent land parcels for the collection of solar energy.

This grant undertook the study of the applicability of the solar envelope to the City of Los Angeles. The concept was developed and presented by the University of Southern California, School of Architecture under a previous grant from SERI. An abridged version of the University of Southern California report is included in Section IV.

The City of Los Angeles was awarded this contract by the Solar Energy Research Institute (SERI) to undertake a study of solar envelope zoning in the City. This contract was a subcontract of SERI's obligations with the Department of Energy.

A special team from three participating City Departments was formed to carry out the project task. The participating Departments were City Planning, City Attorney and the Office of the Mayor.

II. SUMMARY AND CONCLUSIONS

THE SOLAR ENVELOPE CONCEPT

The solar envelope is defined as the largest volumetric container of shadows generated by a built form that allows solar access to all adjacent parcels. As a form of zoning, it is applied by the local municipality and does not depend on private party agreement. This restriction, when placed over an entire area, will produce a series of buildings which only shade their neighbors in a very controlled way. In order to have an impact, the solar envelope must be applied uniformly over a given area of the City.

ADVANTAGES

The principal advantage of the solar envelope is that it is applied evenly over an area. Each property is guaranteed solar access. This predictability encourages the use of solar energy. Individual property owners don't have to go through the expense and trouble of arranging for private easements.

Architectural innovation is also encouraged by the envelope. If a developer is to get maximum floor area in a building he must conform to the shape of the envelope as closely as possible; this creates buildings which step back as they rise. This form creates terraces and, combined with a concern for energy efficiency, promotes the use of courtyards and lightwells.

The city is an assemblage of structures designed for various uses. The solar envelope can reflect this variation. Depending on the rules used for envelope generation, it can protect the whole property adjacent to it or just a building's rooftop. Use of solar envelope regulations can also create new buildings which are responsive to the scale of existing buildings.

DISADVANTAGES

The primary disadvantage of the envelope is that it reduces the predictability of the planning process. Modern city planning designates the location and amount of future development. Residential land use allocations accommodate estimated population projections. Instead of allowing for given densities the envelope only restricts a physical configuration. The number of people who would be accommodated in a given area using the envelope is difficult to predict.

In addition, the use of the envelope would appear to drastically reduce densities in certain areas of the city below those permitted by current zoning regulations. However, this reduction would be present with any solar access system which guarantees access to all buildings within an area. Calculations performed for one site in one section of the City--Encino--indicate that the Knowles' solar envelope would permit a very slight increase in density compared to the proposed specific plan limit--although less than that permitted by the existing zoning. The solar "tent" would provide considerably greater density on the site than would the proposed specific plan limit. Although solar access may not be possible for all buildings in high density areas, the envelope does allow for densities of slightly over 50 dwelling units per acre, a higher figure than has been shown possible with other solar access techniques.

Finally, the envelope may appear to be overly complex for the goal it achieves. It is in fact a sophisticated tool to precisely predict access to the sun. Such a tool probably is not needed in low density areas. Also, the usefulness of the envelope depends upon developing simple techniques for its application.

SPECIFIC CONCLUSIONS

PHYSICAL PLANNING

1. Provisions of the Los Angeles Zoning Code will need amendment to allow for solar access protection.

2. The envelope is less restrictive than some community plans. As the zoning is brought into conformance with the community plans the envelope may seem less attractive.

3. Solar envelope regulations would provide another method for determining setbacks, side yards, and bulk limitations, where these are included for urban design considerations. Existing regulations would not be replaced since they are based on fire access, public health and safety considerations.

4. Other innovative zoning techniques should not be overlooked. Subdivision design review, Specific Plan provisions, solar easements, and required covenants and deed restrictions could be used. These could be used alone or in conjunction with the solar envelope concept. Since the solar envelope is a type of zoning which uses other tools in concert, it offers a great deal of flexibility and consistency. There would also be the advantage that the same governing bodies would be responsible for reviewing these different zoning tools when applied to a land parcel.

THE CENTERS CONCEPT

1. The planned high-density, mixed-use centers represent a special problem because of their high density. They also represent a special opportunity because of the applicability to other urban areas around the country. For various reasons dealt with in the report, it is difficult to assess the impact of the solar envelope on the Centers Concept. The solar envelope may be applicable for both commercial and residential areas in the centers, outside of the very cores of the centers.

2. In order to apply the solar envelope zone in centers the centers will have to be more precisely defined. District-wide solar rules should be developed for the centers and could include provisions for duration of shadows, transfer of development rights and other features. A provision for the transfer of development rights would involve some compromise of solar access, but in extreme cases could be justifiable.

3. The Centers Concept calls for innovative development in three dimensions. This could interfere with complete application of all solar access provisions. Special exemptions could be made for the Pedway System, the Downtown People Mover and other features which might cast shadows not permitted by the solar access provisions adopted. The concept also calls for the utilization of air rights, wherever possible. If these were small developments they might be exempted from the solar access provisions, but where large developments were planned, they would have to conform to the provisions.

ADMINISTRATIVE PROBLEMS

1. Preliminary estimates of the number of cases that the Planning Department reviews in a year, lead to a conclusion that as many as 6,000 envelope proposals would have to be reviewed in a twelve-month period. This number might be drastically reduced, if certain types of land use, such as single-family, and certain cases, such as yard reviews, were excluded. Many of those interviewed were concerned that the envelope would increase costs in terms of time and manpower. Accurate estimates are difficult and these remain only educated guesses.

2. Several aids should be developed to assist in the task of administration of the envelope. The most useful tool would be series of tables to estimate the dimensions and volume of the envelope. Another alternative would be an interactive computer program which could draw the envelope, given lot size and orientation. Ideally, there could even be on-line terminals at the planning counter.

3. One of the major solar envelope use issues is the protection of solar access in dense urban areas. If whole site access is to be protected then density is reduced significantly. A less stringent alternative is to guarantee whole or partial building access and allow any open area around the building to be shaded. This approach forecloses access options for the future. The final, least stringent alternative is just to protect rooftop access. This allows high densities, but limits solar utilization to active systems.

   Professor Knowles of the University of Southern California approached this problem by guaranteeing whole site access in residential development and partial building access in commercial areas. This represents a convenience vs. density trade-off. The application of the envelope, regardless of surrounding structures (whole site protection), would increase ease of application, but tend to reduce density. The application of the envelope, acknowledging surrounding structures, would tend to do the reverse. Most of those interviewed rejected the USC approach.

4. Several opportunities exist for implementing solar access provisions. Several City departments are now working on a Comprehensive Community Energy Management Plan. This plan will become part of the general plan when completed and will include provisions for solar access. The city can also integrate solar access through the normal General Plan amendment procedure. Finally, the city is involved with a state mandated zone conformance task. This task, has as its goal zoning that is consistent with the adopted General Plan.

ALTERNATIVES

1. The Solar envelope concept is only one alternative for solar access protection. As a zoning tool, it has certain significant advantages over those alternatives that are based on private agreements. It is uniform and could guarantee solar access by municipal regulation. The uniformity would allow a developer to count on his solar energy installation as a continuing energy source.

2. Strictly private covenants would be less expensive to the city than a zoning approach in terms of administration and enforcement. Covenants are usually put in effect at the time of construction and are most applicable where a group of new buildings is going up at the same time. This haphazard coverage makes long range planning difficult. Finally, the financial burden for enforcement is switched from the city to the individual; the property owner must seek civil remedy in cases of violation.

3. Publicly recorded easements could be a satisfactory substitute for the zoning approach in certain land use areas. While simpler than the solar envelope, an easement cannot account for as many complexities in siting, surrounding structures, or levels of access.

4. Providing solar access solely by means of subdivision approval is unsatisfactory. The Subdivision Map Act affects only new housing tracts and condominiums and does not affect apartments at all. Too much new development is exempted for the Map Act to be used as a comprehensive way of providing solar access.

COMMUNITY PLANS

1. There is no direct conflict between the solar envelope concept and the community plans of the city. Infact, the community planning process could provide an alternative to city-wide application of the envelope.

2. While city-wide application would insure consistency, there are many arguments for district-wide application. As mentioned elsewhere, the envelope is more complex than existing zoning tools and will require some learning period by city personnel. Secondly, by taking a specific area, application problems can be worked on in the "real world".

3. After examining the Wilshire Park Mile and Encino Specific Plan areas, several issues became evident. To exercise normal planning considerations, some type of envelope definition must be made, on some of the parcels. These are needed to predict the dynamics of density, shading of surrounding structures, and other planning constraints. It also became evident that land use, land values, and physical designs, would be altered by the envelope. In both of the case studies, the envelope reduced densities in comparison to the existing zoning. The envelope did not appear to reduce density, when compared to the ranges of densities called for in the community and specific plans.

III. RECOMMENDATIONS

THE STAFF RECOMMENDS:

1. That the City of Los Angeles adopt a policy of providing solar access protection as soon as possible and that solar envelopes be a part of this protection.

2. That solar access provisions be composed with care, legally as restrained as possible, in order to accomplish the goal of protecting solar access and encouraging solar development, consistent with other General Plan goals.

3. That the provisions for exceptions in the Los Angeles Planning and Zoning Code be modified to allow for solar access provisions.

4. That the Planning and Zoning Code of the Los Angeles Municipal Code be amended to provide for Solar Access, but that these code amendments consider both alternatives to and amendments of the solar envelope zone.

5. That solar access controls be applied to all land uses, but that separate specifically designed access protection be considered for each current land use i.e. commercial, single family residential, multiple, industrial, etc. (These controls might take the form of rooftop protection in single-family areas duration of shadow in centers and performance standards for commercial buildings).

6. That the solar envelope address parcels to the greatest extent possible rather than adjoining structures as suggested in the USC study.

7. That a computerized solar access analysis method be studied for planning and review purposes in which each public counter be provided with instantaneous solar access analysis.

8. That solar envelope controls be applied in conjunction with the enforcement of vegetation controls and strict energy conservation building codes.

9. That Centers be precisely defined and described.

10. That interim solar access protection be provided in zone change and division of land cases by means of conditions of approval requiring appropriate recorded covenants.

11. That the solar access concept be made a part of the Community Plan process, explicitly addressed in all Specific Plans and considered in General Plans/Zoning Consistency Cases.

IV. SOLAR ENVELOPE CONCEPTS ABRIDGED

SOLAR ENVELOPE CONCEPTS
(Abridged Version)*

The solar envelope concept was first developed as a framework for architecture and urban design at the University of Southern California (USC) from 1969 to 1971. In 1976, a directed research seminar was begun at USC to further develop the envelope concept as a public zoning policy. The Planning Department of the City of Los Angeles participated in the seminar and supplied staff working papers on the topic of alternative approaches to solar zoning. In the fall of 1977, and after a year of research to identify legal alternatives to solar zoning, the first attempt was made to test the envelope concept as a straightforward zoning mechanism.

The USC report deals generally with the solar envelope concept based on time (the sun moves by day and season) and space (the constraints of property). The implications of the envelope for active and passive applications are described as a function of duration of solar access and site geometry. Also discussed is the relation between the envelope and the aggregation of separate land parcels.

The envelope's specific application is determined by some conditions of site and context that affect the envelope's shape and bulk. If a rectangular site is incrementally rotated, the impact of orientation on the solar envelope is demonstrated. If the site shape is made irregular, changes made in the envelope's form and mode of generation are easily seen. Finally, if the building context of the site is systematically varied, the impact on envelope bulk and extent of solar access is demonstrated. Measures of development potential, residential densities and commercial floor area ratios, were tabulated for development sites regulated by solar envelopes. The variable impact of the envelope on such urban qualities as privacy and diversity was evaluated architectually through specific images. And out of the numbers and images, new construction prototypes emerged that differed from current development practices.

Some conclusions were reached about the solar envelope and its impact on development, building forms and urban growth in general. The most salient conclusion drawn was that good quality moderate density urban development is possible within the constraints of the solar envelope zoning.

The solar envelope is a space-time construct. Its spatial limits are defined by the parameters of land parcel size, shape, orientation, topography, latitude, and the urban context. Its time limits are defined by the hours of each day and season for which solar access is provided to neighboring land parcels, and the time interval will vary according to land use, and community attitudes about the value of solar irradiation. An appropriate envelope can be generated for any land parcel and for any time interval.

*Solar Envelope Concepts was a report originally prepared by Ralph Knowles and Richard D. Berry of the University of Southen California under SERI subcontract No. XM-9-8155-1, under Prime Contract No. EG-77-C-01-4042. This abridged version was prepared by Al Landini of the Los Angeles City Planning Department as a staff working paper intended to emphasize zoning implications of the solar envelope concept. The abridged version has been reviewed and approved by Knowles and Berry. It should be noted that the rules set forth in this study for envelope generation are just one set in what could be infinite variations. Because of this infinite variation, this report responds to the specific rules outlined by USC.

The most practical approach to the zoning application of the envelope appears to be one that would require developers or property owners to provide the envelope description in conjunction with the normal land survey done prior to the preparation of construction drawings and the filing for building permits. Compliance can be appropriately checked by City building departments.

Buildings designed within the solar envelope are likely to have both new and old architectural characteristics. For example, commercial structures designed within the envelope tend to be lower and to fill more of the site than do present-day buildings. To make the best use of the envelope's volume, both commercial and residential buildings are likely to employ terraces and courtyards.

On those urban sites examined where development was severely constrained by the envelope approach, commercial building densities could be expected to range between an FAR of 2.5 and 5.5, depending on building type, land parcel size, orientation and surrounding context. Under more optimal conditions, it is reasonable to anticipate an FAR possibly as high as 7.5, particularly on sites adjacent to large open spaces.

On urban land parcels zoned for multi-family residential use, solar zoning would easily allow for re-building of between 10 and 60 dwelling units per acre; and there are undoubtedly many land parcels in every city that would provide densities as high as 75 to 80 dwellings units per acre, without a significant loss of amenities.

If solar access were regulated by means of the zoning envelope, building densities would also automatically be regulated on a parcel-by-parcel basis. This would be particularly applicable to urban areas undergoing rebuilding and infilling. Because the envelope is defined in part by its existing surroundings, it tends to mold and scale new buildings to fit the immediate urban context.

Rising fossil fuel prices are forcing consideration of the sun as a direct energy source. Solar access has come to be viewed as a legitimate public policy area to regulate the manner in which neighbors may or may not shade one another.

The solar envelope can be modeled on straightforward zoning regulations with the intent of protecting future rights of solar access for buildings and for land parcels. Depending on duration of solar access, land parcel configuration, and surrounding conditions, the size and shape of the envelope will vary.

The solar envelope's size, shape, and orientation are greatly dependent on the urban form as manifested by a city's street pattern. If shadows are allowed to extend across streets but not onto adjacent land parcels during specified times, solar envelopes over corner lots will always be larger than over inside lots. Block orientation will significantly influence the solar envelope and land assemblage will have different consequences related to direction. A strategy of seeking south exposure in new subdivisions or in urban rebuilding would, over a period of time, result in a differentiation of land parcel size based on block orientation.

A second urban form influencing solar envelope application is land use. Both commercial and housing development nave been observed. Differences between the two appear because a different attitude is taken about solar access for housing than for commercial development.

The attitude taken about solar access for housing is that the entire land parcel be protected. Such protection is guaranteed above an eight-foot privacy fence. The resulting envelope defines the larger volume on residential land parcels without casting shadows above eight feet at the neighbor's property line. When the property line falls between adjacent lots, the envelope slopes to eight feet at the dividing boundary. Where shadows can extend to property lines across the street, the envelope is quite high.

Each envelope's size, shape, and orientation is determined by a specific set of rules. In turn, the contained building's general location and form is regulated by the solar envelope. Solar envelope users have usually intended to provide relatively high densities and solar access to surrounding land parcels, but have also given high priority to life quality including solar access, cross ventilation, and open space. The design results demonstrate that these priorities can be met within the solar envelope at densities averaging 47 dwelling units per acre.

The solar envelopes for commercial development are usually determined by a more complex physical context and by a different attitude about solar access than for housing. Solar access for commercial development is guaranteed with relation to surrounding buildings rather than land parcels. As with housing, shadows can extend across the street within the specified period of access. But unlike housing where access is guaranteed above eight feet at the property line, several less stringent conditions are set to provide greater development opportunities.

These different conditions for solar access to commercial buildings allow some shadowing of existing and of future surrounding buildings. In addition, the solar envelope is extended continuously over adjacent land parcels to allow owners the option of sharing a common wall to gain development potential.

There are two compelling advantages to guaranteeing solar access through zoning rather than through alternative legal approaches. First, zoning is a form of local government control that is necessarily sensitive to specific and immediate conditions. Second, solar zoning can be formulated as a relatively simple modification of present zoning practices that govern building height and bulk.

The solar envelope differs from conventional zoning envelopes in that time as well as space data are required in its description. In fact, time and space become inversely related: the greater the time interval provided for solar access, the less space there will be under the envelope. Determining exactly what cut-off times might be used, then, will depend not only on how much solar irradiation is desired, but also on how much building volume is required to accommodate development needs.

Ultimately, the question of how to establish the exact relationship between time and space becomes a question of balancing sun rights against development rights.

The energy conversion requirements for solar access can be conveniently categorized in terms of three modes of energy conversion. Each of the modes can be used to describe the interrelationships among development potential, solar access, energy conversion and land use.

The first mode, termed roof-top conversion, characterizes solar access to only the roofs of buildings. This would provide the maximum development potential on any given set of sites, but the minimum potential for energy conversion per unit of built volume. Regulation pertaining to the envelope would only need to distinguish between tall buildings that cast large shadows and small buildings that don't. Since the sun's direct radiant energy would need only to be guaranteed to building roofs, any shadowing on the outside walls would have to be considered inconsequential. If light, however, were also a desired component of solar irradiation, the shadowing might imply a need for different uses between the upper and lower floors of a building.

Use of the roof-top conversion approach obviously has the greatest applicability in high density urban areas and would provide the greatest potential for commercial development. Single family residences would reverse the relationship between development potential and energy conversion, but has not been considered in this study of urban applications of the solar envelope concept. In many high-density commercial districts, roof-top access might well be sufficient to allow for the use of flat-plate collectors, in either new or existing structures. But such limitations on solar access would not provide for the broader options of using the whole building for energy conversion purposes.

The second approach to solar energy conversions does involve the whole building. Every building is an energy converter by virtue of the specific heat and density of its materials. Those material properties can be organized to receive radiant energy as heat, to be stored and given up over an appropriate period and at a useful rate. The potential for responding to daylighting needs also increases in this second approach, which is termed the whole-building conversion mode. If this attitude towards energy conversion were to be followed, differences in building sizes must be recognized in formulating solar envelopes and in regulating solar access. For example, small buildings sited to the south of large buildings would allow closer packing than the other way around. Large buildings would have to be spaced farther apart than smaller ones. The certainty the designer or developer would have in planning uses for the roof would, of course, be extended to the whole building.

The potential building volume attainable from this approach is less than for roof-top conversion but the potential uses of solar energy are increased. The whole building's shape and structure could be adapted to conditions of light and heat for improved life quality. This approach is probably most applicable to moderate density commercial and residential development.

The third approach would allow for whole-site conversion and therefore requires a guarantee of solar access to the ground surface of adjacent land parcels. This approach is the one that would provide the greatest potential for energy conversion and probably the least volume for development. The premise of this approach is that all possible users of solar energy--the ground itself, plants, insects, animals, people, as well as buildings--would be guaranteed direct radiant solar energy.

Under this most inclusive approach, solar envelopes would tend to differentiate themselves according to difference of land parcel size. This would result from providing access to the land itself. In general, larger land parcels could be used for larger buildings because the envelopes would be larger.

In cases where more than one building were to be placed on a single site, as in a planned unit development, the proportional relationship between any single building and its immediate surrounds may result in complex sets of buildings in which individual building size and even the sequence of development for solar access might need to be regulated.

The singular advantage of this whole-site approach lies in the generous number of design options it would provide for life quality, making it especially appropriate to housing in the low to moderate density range.

Standard modes of construction have included the detached, single-family residence and the high-rise commercial building. Both are energy intensive.

Solar envelope studies have looked at mid-range building densities for both residential and commercial development. This focus has been based on the proposition that, by replacing or infilling with moderate density housing and mid-rise commercial buildings, the objective of minimizing energy costs for maintaining our urban buildings could be attained over time.

Lower cost for building heating and cooling would result from several interrelating properties of mid-density development. First, mid-density housing generally exposes fewer heat-transferring surfaces than does the average detached house. Second, lower heights for commercial buildings would require less vertical servicing. Third, and most important of all, to reduce the energy demands of our buildings, it has been demonstrated that solar energy can be used very effectively, by both active and passive means, at mid-range densities.

It seems reasonable to expect that a sophisticated integration of machines with more traditional architectural means could well produce buildings that are better in terms of both energy consumption and environmental quality.

Two recurring arguments have been raised against the solar envelope concept. (1) The solar envelope would not provide sufficient building volume to encourage new development in urban areas of moderate to high density. (2) The solar envelope would not allow sufficient design freedom to attain good architecture and urban design results.

Thus, the institution of solar envelope zoning must focus on how to treat the envelope so as to balance development needs with solar access needs. The general strategy can be suggested by which municipalities may develop and evaluate the design implications of the development concept. They can be outlined as a set of steps, stated as procedural imperatives.

(1) Identify a variety of potential development parcels having diverse characteristics of parcel shape, orientation and urban context.

(2) Establish a set of rules for defining solar envelopes that balance development needs with solar access needs and that fit the land use and platting characteristic of the study area.

(3) Generate solar envelopes for each selected building site, using established rules as a hypothetical zoning ordinance which is viewed as being applicable to all future development.

(4) Establish a realistic and detailed evaluation of a building program that reflects the actual development potential of the study area and that complies with the objectives common to speculative development.

(5) Apply the building program consistently to all selected sites.

(6) Identify the range of acceptable building options and the maximum building volumes that can be generated on each site.

(7) Evaluate the feasibility of all building solutions and the implications for development.

(8) If either development potential or solar access potential is found to be too limited, relative to community values, modify envelope rules and reiterate steps 3 to 7.

The basic problem remains how to achieve a reasonable balance between solar access and development potential. In built-up commercial districts, some shadowing of a land parcel's surround can probably be tolerated, so long as no existing or future buildings are deprived of their energy conversion potential in a practical sense. This strategy can be illustrated in terms of shadowing conditions that would have little impact on buildings but would allow envelope volumes to be substantially increased.

The most restrictive envelope condition would allow no shadowing of adjoining land: the whole-site approach to guaranteeing solar access. This means the envelope would touch grade at the site's boundaries.

The most obvious way to increase the envelope height and volume, is to allow the envelope shadows to extend across the street. In effect, the envelope spans the street. This assumes that solar irradiation on the street has no significant energy conversion potential but this might not always be the case. Land parcels located on the corner of street intersections have the advantage of shadowing in two directions, providing corner sites with more building volume than single-frontage lots. All lots, and envelopes, would still guarantee solar access to all surrounding buildings.

Still another strategy is to allow selective shadowing of existing and future buildings as well as streets and alleys. This approach recognized that certain elements of a building, such as roofs, have a clear potential for either active or passive energy conversion. Other building elements, such as fire walls or party walls separating adjacent land parcels, could be entirely shadowed.

Ultimately, it's been found that solar access can be guaranteed for all surrounding buildings, but it's necessary to allow shadowing of thirty percent of all window walls, and one-hundred percent of all fire walls. This seemed to provide the best attainable balance between guaranteeing solar access and encouraging future development within commercial areas.

As this strategy was finally applied in the design of commercial office buildings on actual sites, it increased the envelope's volume to almost five times what could be obtained by the whole-site strategy. The resulting building designs attained gross floor areas averaging almost four times their site areas.

A fundamentally different approach might seek to increase envelope or development volume by altering only the period of solar access. One such variation would guarantee solar access for only six months of the year (spring through summer to fall).

The strategy generally followed in dealing with residential development is to guarantee year-round solar access to all neighboring sites, allowing shadowing of the streets. Where whole-building access is provided in the commercial area, whole-site access is provided in residential areas.

However, in order to increase envelope volume and attain more realistic densities, the final strategy used in residential areas allows shadowing up to eight feet above grade and from there is generated to guarantee a specified period of solar access for each day of the year.

The basic principle underpinning this strategy disallows any construction at the property line that would cast more shadow on the surrounding lots than would a one-story, single-family house set back five feet from the property line. An eight-foot wall or fence on the property line produces this extent of shadowing under the conditions found in residential areas.

Where the property is shallow, these envelope requirements become most restrictive on development sites located on the north side of any street running east-west. Such envelopes are steep on the south face and gently sloping toward the north. In some areas, shadows from the envelopes can extend over a wide street on the south while the envelope may stop eight feet above grade at the north property line, where existing houses are sited with normal setbacks.

Solar zoning is presumed applicable to all sites. In formulating a hypothetical zoning ordinance, specific rules must be developed. Some guides to developing the rules are:

(1) Consider any building to be a total system having the potential to utilize solar energy through either passive or active mechanical means; sunshine or shadow on open space is of no relevance.

(2) Solar irradiation must be available for at least six hours per day in order to provide energy that is sufficient for practical conversion purposes within a building.

(3) Existing building patterns in the area plus real-estate values should be considered in determining floor area ratios (FAR) for new construction.

(4) Rules for generating solar zoning envelopes must be sufficiently explicit and sufficiently generalized to accommodate any development proposal and to guarantee solar access to all existing buildings that might surround any parcel.

(5) Once a solar envelope has been determined for a specified development land parcel, the zoning envelope is defined, limiting future construction height, bulk and setbacks: in effect, no building or landscaping element may extend outside the envelope.

(6) Current zoning regulations impose no front, side, or rear yard setbacks on properties zoned "commercial," which will be maintained in the solar zoning applied to the study area.

Specific rules for use in generating all zoning envelopes for commercial sites can be stated as follows:

(1) Provide solar irradiation to all surrounding buildings at all times of the year between the hours of 9:00 am and 3:00 pm solar time. (In effect, this interval will provide maximum potential heat gain at the winter solstice while mitigating heat gain in the summer: about 77% of the aggregate daily energy that is theoretically available on a winter day and about 45% of what is available on the summer solstice at 34N latitude.)

(2) To protect solar collector plates that might in the future be placed on any nearby roof, the solar envelope for a land parcel cannot extend above the roof parapet of any existing building during the specified hours of the day.

(3) If a development parcel adjoins one or more vacant sites, then a single envelope may be constructed under the assumption that fire walls would be built at the common property lines when new buildings occurred.

(4) Parcels of land containing only temporary structures or having structures whose bulk is 10% or less of the allowed F.A.R. may be treated as vacant parcels for purposes of establishing a solar envelope.

(5) Walls of surrounding buildings that serve as fire walls or that have no significant windows in them have little or no potential for utilizing solar irradiation, and such walls may be totally shaded by a solar envelope.

(6) Walls of nearby buildings that function as window walls or that have window openings that exceed 25% of the wall area may be partially shaded by the solar envelope so long as no more than one-third (33%) of the wall is shaded during the specified hours of any day of the year.

For example, on a mid-winter morning, the lower 1/3 of a nearby office building may be shaded (such shadows are in effect transitory and would allow solar access to most of the building wall most of the day and most of the year).

(7) If a development parcel has nearby vacant land parcels located on the opposite side of a public right-of-way (a street or alley), then the vacant parcels shall be treated as if they had buildings on them (which they will have in time). Any hypothetical future building on the vacant land must necessarily fit within its own solar envelope; hence, generate the solar envelope for the vacant parcel and assume that a full height window wall will eventually be built on the property line that fronts on the right-of-way. Under this condition, the solar envelope for the developable parcel may shadow one-third of the assumed window wall. However, if a solar envelope cannot be determined for the vacant parcel, then the envelope for the developable parcel may cast a shadow on the botton 20 feet of the hypothetical wall.

(8) If the walls or roof of an existing low building are shadowed to a greater extent than what is imposed by an intervening solar envelope, then the solar envelope may be raised vertically until its shadow impact equals but does not at any time exceed the existing tall building's impact. In general, the increase in the envelope height will be proportional to the ratio of horizontal distances between shaded building and the solar envelope and between shaded building and the tall building which is producing the shadows.

(9) The solar angles to be used in generating envelopes apply to (latitude 34N) at 9:00 am and 3:00 pm sun time (Bearing angles are for east and west of North at the given cut-off times).

Time of Year	Bearing Angle	Altitude Angle
Summer	94o	50o
Equinox	120o	35o
Winter	137o	18o

This design, because of its rigorous control of daylight, raises an interesting issue of time constraints. The solar envelope was designed for the six-hour period from 9:00 am to 3:00 pm all year. On the other hand, normal office hours run from 9:00 am to 5:00 pm This potential conflict between envelope cut-off times for energy conversion and traditional cut-off times for work days can usually be resolved by design but may require some future resolutions by public policy.

Unlike the envelope rules that were needed for commercial sites, the housing sites can be handled by zoning rules that are quite simple because the conditions surrounding all such sites are more or less the same. However, the general premises regarding the envelope remain the same as for the commercial sites.

Because of neighborhood residential characteristics, it is appropriate to take a whole-site attitude in providing solar access to surrounding properties.

There is, of course, the need to provide sufficient development volume under the envelope to attain densities of between 40 and 60 dwelling units per acre. Hence, some minimal shadowing of adjoining ground surfaces is necessary. But, it is generally agreed that any such shadows should not exceed what would be produced by a 1½-story, detached single-family residence with a normal side yard. In effect, this degree of shadowing is what an eight-foot wall or fence would produce, located directly on the property line.

The specific rules used in generating the solar envelopes over residential sites can be stated as three simple zoning requirements.

(1) Provide solar irradiation to all surrounding properties at all times of the year between the hours of 9 a.m. and 3 p.m. solar time.

(2) Public rights-of-way may be shadowed by buildings at any time of the day, all year; hence, the solar envelope for any parcel will span adjoining streets or alleys and meet the property line on the opposite side.

(3) The base of the solar envelope for any land parcel will be set at a height of eight feet above existing grade, at the parcel boundary or the property line on the opposite side of any public right-of-way adjoining the parcel. Where the existing grade along a property boundary has significant slope, the average height of the envelope base may be set at eight feet, but at no point may the base extend more than 10 feet above the grade of the adjoining property. This rule is unique to housing but analogous to two of the commercial envelope rules.

V. APPLICABILITY TO THE CITY PLANNING PROCESS

A. INTERVIEWS

One method of protecting solar access is the solar envelope zone. The solar envelope has been defined by Professor Ralph Knowles in his work at the University of Southern California, School of Architecture as "the largest volumetric container over a land parcel that allows solar access to all adjacent neighbors within useful time constraints." The University of Southern California work used the hours of 9 a.m. to 3 p.m., solar time at 34 N for the City of Los Angeles.

To attempt to answer the numerous unknowns on the effects of the zone on City operations and procedures an interview method was used. The Senior Planning Staff, and those experts in certain phases of the administrative and planning processes were interviewed. The results of those interviews are described in the following paragraphs.

INTERVIEW

CALVIN HAMILTON--CITY OF LOS ANGELES PLANNING DIRECTOR

by Dave Gay, October 3, 1979

Question: Having previewed Professor Knowles presentation of the solar envelope concept at the University of Southern California what are your general impressions of the approach to solar protection and its application in the City?

Answer: I completely believe that we ought to try to find a method to use the envelope in the City. I think in particular that it is appropriate for solar collectors and residential passive solar protection as well. I await the results of this study or future studies before I will arrive at conclusions on the specific applications especially in Centers. I am not sure if the trade off in heights and other planning objectives in the Centers such as concentrations for rapid transit will outweigh the need for solar access. I'm not sure what the trade offs are.

There is no question in my mind that the protection of solar rights for housing, in particular for protection to have the sun during a particular part of the day is very important. Apartments may need the protection even have more than single family areas because in single family areas you have a yard area to place panels or simply enjoy the sun; you have more flexibility.

So, I believe in it 100%. However, I think we need to look at it very carefully in terms of the rights for solar access versus/or in relation to other planning objectives.

I think in terms of the envelope and its application to different sizes of parcels, there are many legal problems and administrative barriers. I don't know how I would write an ordinance that would apply if the lots were 50 ft. wide versus 150 ft. or what is the right way to apply the envelope if you collect three lots together. There are examples in Hawaii where a developer can build, lets say to a certain density such as a 1 to 1 floor area ratio on a lot 50 by 100 ft. but if you have an acre and a half lot you can build say about 8 to 1. That does not make sense to me because what is happening is that everyone is collecting lots together and consolidating them and then building to a tremendous density. And apparently the more lots you collect in some circumstances for solar envelope purposes you can get more intensity than if you have single lots. Therefore, I think we have to be very careful about the other implications of such an envelope zone, other than just solar rights.

I think the experiments Ralph Knowles has made at University of Southern California are very interesting and very important and I think they ought to to give us clues so that if its possible to orient streets east-west rather than north-south or orient the structure for maximum solar access, then I think that we ought to make sure subdivisions are designed that way. We ought to apply the concepts whenever we can.

I think that from an urban design point of view the big advantage I see from the concept is the innovation in architecture. I would love to see development such that you just never build the rectangular box R3 apartment houses because of the solar envelope. Some of the students suggested designs are infinitely more innovative, it seems to me, going back to good architecture. I think it would be great if we could use solar constraints to no longer have houses built without regard to site or terrain.

Question: I've given you an abstract of what some of the other senior staff members have told me during the interviews concerning the solar envelope. Can you comment?

Answer: In relation to the subdivision provisions that Jack Sedwick mentioned (see page 29), I want to be as stringent as possible with solar provisions.

I don't agree with the senior staff position of wanting to take the solar concept very slow and easy, trying it in specialized areas. Almost every innovation which has come about in this Department has been resisted by staff and they all say let's go at it slowly. We had the same reaction when I first proposed we go to citizen participation, it was resisted. The goals program was at first resisted along with dividing the plan areas into communities. It's good that staff is cautious because I would go too fast too far. The staff in a sense is dragging me back because they are saying lets be more cautious. So I guess, in balance we have done things in a more deliberate way than I would like but far more bold than most of the staff members would like.

Question: It has been suggested that staff develop the ordinances necessary for the zone but start by only applying them on a specific plan basis.

Answer: If you have a good ordinance, why limit its application? It isn't as if solar energy is new or that one area of the City deserves more access than another. In 1909 most of the water heaters in the city were heated by solar panels. It wasn't until we got natural gas that we got rid of all the solar equipment. In Japan you can see thousands of solar panels. Why should we wait to guarantee access in the City. It does not make sense to me.

On the other side of the coin we want to make very sure that what we do is good, and right and maybe we should experiment in specific plan areas. That does make sense, but we certainly should write our ordinances. I can't see only doing a dribble here and a dribble there. It is not fair to those people that we pick out from all possible property owners. Now if we wanted to have experimental work at certain locations and the developers volunteered to cooperate with our study that would be a different story. I cannot see using the concept selectively unless there is very good reason.

We do however need to move into the implementation in a sequenced balanced way that can be defensible in each increment that we apply it. What do I mean? It may be that at this point, to have the solar envelope apply differently to different configurations of amount and type of land, maybe we don't know how to apply that correctly in the beginning but maybe we do know how we should reorient lots, how the envelope should be shown as part of any building proposal. I really don't think we are ready to jump in with both feet in the ultimate sense of what we might want to have. I don't think we have done enough experimental work or looked at all the implications. And so I agree with the staff when they say lets move logically and slowly, but I'm not sure I agree with applying it only intermittently or on a hit or miss basis. We want to apply it in blocks or building blocks that will lead to the ultimate requirements City wide.

Question: Can you think of a better method than the zone to protect solar access? It has been suggested that easement, or private covenants might satisfy the access requirements.

Answer: Private deed restrictions would be hard to apply to land already subdivided. I don't have any objections to private deed restrictions but they don't last but 30 years and it costs money for other property owners to enforce them and the courts are very slow in enforcing them. I think that if a private developer wants to go further in his development than what the public is willing to enforce then I think that's great. But I think that we have a responsibility to save energy and protect solar access. There is no reason to wait for individuals to decide that they want to apply private deed restrictions because the City cannot be a part of their enforcement.

Question: You seem to be a proponent of the concept of transfer of development rights. What are your views on the transfer of solar development rights?

Answer: I think that is going to be absolutely necessary in our central areas. I don't yet see how we can apply solar rights in our Centers. I'm not sure that certain smaller older uses will justify prohibiting a new development complex that is needed and logical for other planning reasons. However there are areas such as along Wilshire Boulevard with adjoining residential uses, essentially transition areas, where solar access protection should apply and perhaps the opportunity to purchase solar rights should exist.

Question: Are there any areas that we should eliminate from consideration for solar access protection?

Answer: I think that we have to look at the objectives of a solar protection ordinance. The most important objective is to supply an energy source. If we are really running out of energy, and we are, if we can supply a good amount of energy, and we can, then apply the zone because the objective is just as valid for an industrial complex as it is for commercial or residential area. The ordinance and the regulations, however, have got to be uniquely tailored to the particular requirements of those areas.

Question: One of the criticisms of the University of Southern California concept is that it is tailored to existing surroundings and will change as an area changes. What are your views on the concept and the criticism.

Answer: I don't have a definite answer to that but I think that it depends on the particular area and type of building. I don't think you can make a blanket statement although I would guess that as a concept of protecting the land rather than the existing structures would make sense but I would have to think about it more. I think this study should attempt to answer the question "Should the envelope change with time and surroundings" "should it change as land is accumulated" . You have to have clearly in mind what your planning principles are as you tailor and apply the specifics of the solar envelope. I think that is the toughest part of your study: trying to think through those implications. I think the subdivision process should be one of the steps toward guaranteeing solar access but not necessarily the major step. The administrative problems are tough. I think that you should formulate the major options as you see them, with a delineation of the kind of goals those options would be oriented to achieve and then what kind of benefits and determinations those options seem to be oriented to. Then you have a basis to address the subject. You have the broad objective and the goals of this particular option and here is the way you carry out that option in broad outline and here are the implications of that option. If given the various options we can then weigh one alternative against the other. That is the essence of planning to me.

Question: One of the complaints from some of the staff is that to use the envelope properly, each lot or parcel and structure must be examined individually. What are your comments?

Answer: We are no longer getting 2000 units in a subdivision. And most developers, if they are doing a 2000 unit development do it in increments and they look at every house. It is very different than it used to be back in the 40's and 50's.

I would like to comment further that there are objectives coming out of the concept other than just solar access. I see it as a major vehicle for restructuring the whole physical character of the city, and that to me is one of its most exciting aspects.

INTERVIEW

GLENN BLOSSOM--PLANNING DEPARTMENT CITY PLANNING OFFICER

by Dave Gay, October 1, 1979

Question: After looking at the summary of the solar envelope zone what are your views on this approach to protecting solar access?

Answer: Generally I think a subdivision approach to solar access would be too slow. The City is too developed for that approach. Solar access protection only makes sense on a zoning basis and it's more needed in the more urbanized part of the City. I see the solar envelope concept as perhaps an adjunct to the zoning consistency program that we are working on in the Department, bringing zoning into consistency with the General Plan. The real approach is to first establish objectives in the General Plan and then to apply those objectives through various land use controls. I would say that protection should be given to the parcel rather than any existing structure as proposed in the University of Southern California study or to certain portions of that parcel.

Question: Are there any areas of the City that you think should be exempt from solar access protection provisions?

Answer: I would exempt both single-family areas and defined Centers. I would try to deal with Centers on an area basis.

Question: Would you prefer to see a different method of solar access protection such as covenants or easements?

Answer: I don't think covenants are going to do anything. I think that access protection has to be applied through the zoning code in a uniform and controlled manner. There should be a combination of the zoning text and the zoning map amendments to provide for solar access protection.

Question: What kinds of administration problem, if any, do you foresee in working with the solar zone?

Answer: I classify this type of zone control in the same category as performance zoning. There is considerable literature on performance zoning and the solar envelope concept has similar kinds of drawbacks. You have to have some experts on hand and methods of evaluation to administer it. You have to do a cost study to determine if this would all be worth the effort.

Question: What do you think of the concept of transfer of solar development rights?

Answer: I am generally very skeptical of the concept. I don't think it is a very workable condition. I think there are better land use controls than transfer of development rights.

Question: Do you see any specific changes in the suggested rules for the zone as listed by University of Southern California?

Answer: Under item three of the residential site concerning setting the envelope at a height of 8 ft. above the existing grade there should be further wording for hillside areas and non level sites. I can't really comment about any of the commercial provisions because they relate to surrounding existing structures. I think a parcel has to stand on its own has got to pretty much ignore the fact that an adjoining parcel is or is not developed. Sooner or later the existing structures will be torn down and replaced with something else.

Question: Do you have any further comments you would like to make about the concept?

Answer: I think one of the keys to this whole study is the kind of provisions that can be made for intensely developed areas.

INTERVIEW

THOMAS GOLDEN-CITY PLANNING DEPARTMENT, CHIEF ZONING ADMINISTRATOR

By David Gay, October 1, 1979

Question: Given the need for solar access protection, do you think that a solar envelope zoning approach is the proper approach?

Answer: Yes and no. Covenants have the advantage that they are not the responsibility of the City to enforce but then the City would have no control over them, as they are essentially private contracts. When you talk about a zone that implies that it could be used somewhat judicially. You would only use it in areas where you thought it would be appropriate. I have a little fear of the envelope zone in a developed area. I don't think it can be used as a blanket over the entire City and have it be applicable to all appropriate properties.

Question: How do you think the concept should be applied?

Answer: I think that its greatest application would be in new subdivisions. There you could do it by a separate zone or more logically make it part of the requirements of the subdivision. The problem with the subdivision approach however, is that the subdivider does not have the exact siting in mind. The type of house the height and so on for each lot. To cover it all at that point in time is a little difficult, unless you made it some type of follow up requirement that would require the final plan to be submitted to the Planning Department or require the Advisory Agency to review the plans to insure compliance with the solar access provisions requirements written somewhere into the code.

Question: Do you think solar access should be given high priority in development considerations?

Answer: I do, but I think that the zone concept is an overreaction. I don't know what the acceptance would be to some of the provisions by the general public or developers.

Question: Talking about solar access; how much protection should we provide?

Answer: If we are going to control solar access at all it should be controlling development of individual lots as it affects adjoining lots. We cannot consider existing structures, as this seems like unequal protection and application under the law. (See City Attorney's Report)

Question: How should we approach the City's initial entry into the solar access protection field?

Answer: Before we launch into any progam of this kind I think we should think it out very carefully and its application to just about every possible situation. In old areas and in new areas so that we could anticipate what we are proposing to have wrought. I am a little worried that we gallop into these controls too fast and then have a great many exception cases.

With our energy crisis we certainly have to try to encourage solar development. I have no objections to developing an approach to solar access protection. One way we might approach it is to have some specific code amendments so that this office can permit deviations from the yard requirements instead of variances, for specifically solar reasons. We make it easier for people to secure deviations from the code for solar access and as we gain experience from these provisions we could develop the zone in a proper manner. Where we do have legitimate requests to deviate, under administrative regulations for solar access then it should be easier for us to do so than go through the variance. We cannot presently legally grant a variance for strictly solar access provisions.

INTERVIEW

BOB JANOVICI—CITY PLANNER ZONING ADMINISTRATION DIVISION RESEARCH ANALYSIS SECTION

By David Gay, September, 1979

Question: How much solar protection do we want to provide? i.e., should we protect a parcel from shading, should we protect the south wall of a building from shading, should we protect just the roof of an adjacent building from shading or should we merely protect existing solar panels?

Answer: I cannot really answer the question by a simple yes or no response. As you are granting or protecting solar access it seems that you may be taking away another person's rights to develop their property. We have enough complaints already about the building setback requirements without introducing a variable setback.

Question: Should there be areas of the City or land uses that should be exempt from solar zoning? i.e., should centers be exempt or should single family areas be exempt or should the envelope just be modified for each of the special areas in question.

Answer: It would seem the best course would be to modify the solar envelope for each special area individually and then perhaps only for new developments. Where you can deal with a specific area as a whole it would be best to do rather than prejudice existing property rights by dealing on a parcel by parcel basis, in already developed areas of the City.

Question: Can you forsee a Citywide application?

Answer: I would not want to see Citywide application initially. I think first field trips should be used to find areas that are particularly adaptable to solar envelope zoning.

Question: Is there a better method of solar rights protection rather than the solar zone? i.e., easements, private covenants, changes in the code set backs and bulk limitations?

Answer: It would seem that private covenants would be an advisable way because they are less expensive to the City in terms of administration and enforcement. The City would not have to hire additional building inspectors to verify that solar envelope constraints are being adhered to. Private individuals can enforce covenants through the courts if necessary rather than have the City having to create a legion of enforcers. The covenants would run with the land and there should be no problems of tracing through a title search.

Question: Can you see changes in setbacks rather than the solar envelope zone?

Answer: Under solar envelope zoning you do not have a consistent setback. That's one of the advantages to the code now. You have a precise setback so people know where they stand. If you had one that varied from lot to lot, then for the unprofessional applicant, there would be problems and confusion.

Making solar access the overall consideration is not a good approach, and there are potential traffic hazards and safety to be considered in varying setbacks or allowing greater envelopes on corner lots.

Question: Would people be more willing to have the solar envelope zone in return for the solar access if they understood what they were receiving in return?

Answer: There are a lot of people at the first instance that even question the right of zoning to regulate anything on their property. I think that most people like the setbacks and requirements as they exist until they go to add on to their own property. (I'm talking about residential property). Then, they are frequently upset upon being told a yard variance is necessary as a precondition.

Question: Should we allow the subdivision process to be the major step toward instituting solar access protection rather than the solar zone?

Answer: I don't know that it should be the major step but I think that it should be considered as ranking high because it allows you to deal with one integral development. Everybody in the subdivision would be treated equally in the sense that the City is dealing with one owner at least at the point that the subdivision is being proposed and you would not have to deal with 50 or 300 individuals in terms of one getting something that someone else is not. Solar access would have been planned out before anything in the area was put on the ground. Developers would be buying the land with the full knowledge of what the restrictions are, and we can require as a condition of subdivision that individual buyers be notified as to what buildings restrictions might be in the future, in terms of add-ons and things of that nature. The buyer would have full knowledge of that beforehand rather than impose it after the fact.

Question: What might be some of the administration problems of a solar zone that changes with time and place?

Answer: There is no doubt that there would be tremendous costs to the City and to the applicants. Most applicants currently have a very difficult time filling out existing applications, and I would say that 80% of existing applications for variance and conditional uses (all of which require a plot plan to be submitted; and are required only in the most rudimentary form) seem to pose a great problem for most applicants. In a single family dwelling situation, probably 70 percent of the owners do the application themselves and invariably there are mistakes.

Question: In looking at the envelope would you say that the owners would have to hire a professional to provide the proper application.

Answer: Yes. If not that then the City would have to provide that service. We get in the neighborhood of 800 plus yard cases filed a year plus slight modifications. I would say that you would have to hire two more people at our counter downtown and possibly one in the Valley, West Los Angeles and San Pedro. You are probably talking about three or four more staff members to provide the service. We cannot keep up with what is filed already even without this envelope concept. If applicants went out and hired somebody the review would take longer than it does now, so we would still end up having to hire people. I think in addition that it would slow down the processing of cases because the investigators would have to go out and verify the conditions as they normally do anyway, but here you have additional considerations and its not a simple little measurement they would have to be figuring out, but complex geometry and maybe we would have to buy some additional kind of equipment or whatever to take readings or make envelope diagrams. . . . I don't know.

Question: What specific changes, if any, should be made in the proposed guidelines for the zone?

Answer: I don't want to answer that one because basically I disagree with the concept in general.

Question: The solar zone is proposed to eliminate or modify the need for normal set backs, height limit, FAR's, etc. How will this affect your work?

Answer: It could potentially remove or modify the front and side yard requirements for lots which I do not feel would be desirable, in terms of aesthetics, safety and health. It could create a really bizarre pattern of development in terms of lines of sight and things of that nature.

It seems that the bulk of the building will tend to be spread out more on the lot and the height lowered.

INTERVIEW

JACK SEDWICK - PLANNING DEPARTMENT, DEPUTY ADVISORY AGENCY

By Dave Gay, October 1, 1979

Question: You recently sent a directive to the subdivision staff regarding solar energy systems reports to be submitted by developers during the subdivision process. Can you tell me what the directive was about, how the developers are responding, and what their reports will contain?

Answer: The requirement came at the advice of the City Attorney. He instructed us that we needed to start making certain solar findings. Since the middle of July 1979 we have been requiring, in a modest way, these reports from the developers. Most of the developers have submitted a letter requesting 30 to 90 day extension on the requirement. We have generally granted the time extensions and just recently received our first solar energy system report. Some of the reports seem decent for a new requirement and I understand that they are costing about $300 for consultants to do them. We have also prepared a series of findings that we hope to start applying to all of our tracts. We have yet to apply solar findings to a tract. Most of the reports thus far have looked at the tract in general and not the individual lots and structures.

Question: What are your feelings about Citywide application of a solar zone?

Answer: The biggest difficulty you have is the enormity of the problem. When you have 463 square miles within the City, and you have to go through 850,000 lots and look at their zoning and various conditions it becomes an almost impossible task.

Question: If the zone is a given, what approach to its application should we take?

Answer: The specific plan approach seems most appropriate. It seems the only way you can get a handle on the zone.

Question: Would you rather see some other approach to solar protection and solar access, rather than the zone?

Answer: Private convenants and easements would seem to be more readily available and easier to apply. We might also look at Q conditions on an application for a zone change. ("Q" is a qualified classification change of zone. The development of a site may be qualified to conform to certain standards, if such limitations are deemed necessary to protect the best interests of and assure a development more compatible with the surrounding property or neighborhood or to secure appropriate development in harmony with the objectives of the General Plan).

Question: What might be some of your staff and operation problems with solar access provisions for subdivisions?

Answer: The review period would be increased. We would have to take our cue from the State requirements and then determine how stringent we wanted to be. Some of the requirements are seen to be at cross purposes.

INTERVIEW

FRANK EBERHARD--SENIOR CITY PLANNER, COMMUNITY PLANS

by Dave Gay, October 3, 1979

Question: As the planner in charge of the Park Mile Specific Plan can you briefly give some background on the solar access protection provisions of the Plan.

Answer: We initiated the Plan about the time that solar envelopes were first being talked about in the City, so most of us did not know much about them but the Director was strongly supportive of the idea. We had two proposals. The first envelope proposal was to draw a line from the sides of the proposed structure at a 30 degree angle forming a tent. This was fairly restrictive and as a matter of fact it was too restrictive economically. We decided to move the envelope out and expand it. The second proposal was to start at the property line with an eight foot wall and project a line at an angle of 30 degrees from the top of the wall as the area in which a structure could be built. This was to approximate the angle of the sun and shadows at the winter solstice. The advantage was that this was a fairly easy straight forward approach and permitted development from an economic point of view.

There was really little discussion about the solar access protection aspects of the plan by the Planning Commission and City Council. There was only one short report done on it during our study which said that there was little difference between the six-story or the three-story height limits in terms of shadow impacts on adjoining properties.

The Director was concerned, however, that a solar envelope was essential to the protection of residential uses. The developers were upset about it, but they were upset with everything that had happened by that point in the Plan's development. There was just an atmosphere of being unhappy with what was going on. There was really little intelligent public discussion of the provisions, because the politics at the time of the solar provisions introduction came to a point where the Plan had been developed in reaction to what the public was really unhappy about. It had all the community in favor of that Plan and almost anything you put in the Plan would have been accepted as long as it did not change the basic substance of it. The idea was to protect the single-family area that adjoined commercial areas. The argument was really a compatibility argument rather than a solar rights fight. There was really no focus on the solar rights issue.

Therefore we have this solar provision which I suppose is precedential by the fact that it is in there. In my opinion, you could have gotten about the same effect with a simple six-story height limit, without an envelope concept. The real value of the provision is that you now have a precedent; that it exists somewhere. Physically in this area it will not have that much of an impact. The yard limits the lot coverages and the height limits all have more impact than the envelope in this case.

INTERVIEW

GARY MORRIS-- ENVIRONMENTAL REVIEW SECTION

By Dave Gay Ocotober 5, 1979

Question: What are the current EIR requirements with regard to solar access protection provisions?

Answer: There are two things that I think relate to your study. The first has to do with a requirement that energy conservation must be considered in the preparation of an EIR. That provision is in the appendix of the City guidelines. The EIR is not complete unless it has some consideration of energy conservation which should include solar. For about the last three or four months we have been requiring that solar be given a great deal of consideration. The reports from the developers are beginning to become standardized. To a large extent they are falling back on the building code requirements for insulation, window area and so on. Some of the larger projects are talking about the ability to retrofit for solar devices. The best discussion that I have seen thus far is by Ultra Systems, particularly on the large condominiums, or large office buildings. Otherwise everyone else is not exactly sure what to do.

The second area of EIR involvement is our environmental assessement forms where we ask various questions about the development. It would not be hard to become more stringent in our requirements for greater analysis of solar provisions if the law supports us. The way it now stands is that the "applicant shall discuss". I don't see any reason why we could not attempt to detail that discussion of solar access to particular points. Right now we probably don't have the experts to properly review the detailed analysis even if we were to receive it.

INTERVIEW

H. KEHMEIER--DEPARTMENT OF BUILDING AND SAFETY PLAN CHECK DIVISION

By Dave Gay, October 4, 1979

Question: After a brief look at the proposed envelope concept what are your impressions?

Answer: It seems to me that you've used a set of zone code provisions for years and said that they were very important; so important that it takes quite an extensive variance to change them and here all of a sudden because of the idea of shading requirements we want to forget all that as long as we stay within this envelope. Solar access protection may be valid but I wonder if it is any more valid than the reasons for which the building and zone requirements exist that we presently have (health, safety, light air, etc).

Question: What might some of the administration problems be with the solar envelope zone?

Answer: Right now somebody can come and ask how many units he can build on a particular parcel in a particular zone and we can tell him some number of units with a particular height limit and building area limit. But under the envelope zone we don't know how big a building they can build. They are going to have to draw a solar envelope and get that approved before we can answer their question of how many units they can have. The effect will be land use controlled by building design rather than zone.

It would make it much more difficult to develop a piece of property because no one will know what can go on it until the envelopes are drawn.

All of this would be done under plan check procedures, a building inspector would not be involved.

Question: Is there some other method you would rather see used to protect solar rights?

Answer: I would not like to see it handled through subdivisions. It becomes an indeterminate until after the subdivision is designed. You have to go through the subdivision before you can determine the number and type of envelopes and units that would be allowed. It should be something that is determinable by a professional person in advance.

Question: Do you see any area that should be exempt from the provisions of the zone?

Answer: It would seem that the Centers or highrise areas have intrinsic right to be high-rise.

Question: How much protection do you think we should provide?

Answer: It seems unfair to limit a given property owner based on the existence of a solar panel or the existing surrounding of an area. Your development constraints should be the same if there is a vacant lot or a building adjoining your lot. You should assume that all vacant land will be built upon. You are making a mockery of the code if you place an overriding concern of solar protection and ignore the rest.

Question: Do you think there would be a tendency to accumulate parcels in order to gain bulk under the envelope zone?

Answer: I"m not sure there would be much accumulation. Not all developments gain by larger size. The fact that they can build a bigger building may not be that much inducement in some areas.

Question: What do you think of the concept of transfer of solar development rights?

Answer: It would be a way for a Center to operate. I see no problems with it except more bookeeping.

B. STAFF ANALYSIS OF INTERVIEWS

Many concerns regarding the solar envelope concept and its application to the city planning process were brought out in the interviews. Concerns about the solar envelope are in some cases concerns about the specific rules as drafted by the USC School of Architecture and not about the solar envelope concept itself. Where feasible, staff has recommended amendments to the USC outline to provide acceptability and workability in the City. The envelope concept is relatively new to the Planning Department and Building and Safety Department officials interviewed, but they have had some working knowledge of various other shadow provisions in the City. The Century City Specific Plan has a "duration of shadow" clause, and there is a shadow impact provision in the Park Mile Specific Plan. In addition, Planning nd City Attorney staff have been involved with several drafts of a solar access ordinance. But because there is not a consensus of opinion among these experts on the details and impacts of solar access provisions, it will take time to bring a strong solar access protection role to the City. The need to provide a sound, workable foundation to the City's initial solar access provisions may be a reason to adopt a multi-action approach: specific plans, community plans, code amendments, exemptions, subdivision approval process, etc.

Many of the comments about the effect of the solar envelope on development are true for all types of solar access protection. The geometry of solar access is dependent on time limits, sun angles, and required levels of access, and not on the solar envelope. If a rooftop area's solar access is to be protected during a certain period of the day and year, then any development to the south will face identical geometric constraints, whether built under the solar envelope or other type of restriction. Complaints concerned about limits to density and the solar envelope are really complaints about limiting development to a given level of solar access, and are not necessarily criticisms of the envelope concept itself.

THE GENERAL PLAN

CENTERS

The General Plan of the City of Los Angeles serves as a basic and continuous reference in guiding, coordinating and regulating public and private development in the City. The Concept Plan declares the intent of the City Council toward the future form and long range development of the City of Los Angeles. It is the basis for the subsequent, more detailed portions of the General Plan. The Concept Plan lists several objectives and features that involve to the land form configurations which could conflict with implementing the solar envelope concept. The plan suggests "the preservation of the low density residential character of Los Angeles, except where high density centers are encouraged." Centers are defined as an area

> "With high intensity of varied urban activities: residential, commercial, cultural, recreational and appropriate industrial uses.
>
> "A typical center will function as a focal point for adjacent suburbs and nodes and will have a core of about ¼ mile radius containing a rapid transit station, high rise office structures, department stores, hotels, theaters, restaurants, and government offices. The core will function on a three-dimentional basis with controlled use of air rights. Schools, churches, government offices, public facilities and housing can be located on upper levels of commercial buildings. The design of major developments will make provisions for adequate usable open space, child care facilities and other desirable conveniences."

This emphasis on high density land development creates special problems for implementing the solar envelope concept. Centers generally involve a design component: often with high rise towers; a density objective: relatively high density; and, an economic result: fairly expensive land.

While the densities suggested by the Center's Concept can be reached using the solar envelope, the physical configuration of the buildings would have to change. Medium density residential units, i.e. 40-50 dwelling units per acre, and moderate density commercial, i.e. 3-1 and 4-1 floor area ratios, are possible to develop using the solar envelope concept, but, not in the high rise towers or medium rise towers mentioned in the Los Angeles Concept Plan. Several of those interviewed believed that the Centers, or particularly the cores of the centers, had an "intrinsic" right to be both high-rise and high density at the same time and should therefore be excluded from the envelope concept. The question here is whether the Centers Concept, even perhaps the core of center, can exist with the high density development, but not high rise configurations.

It should be remembered that the Centers Concept is designed to facilitate mass rapid transit which may have overriding energy-saving implications. Hopefully MRT and solar energy can be simultaneously accommodated.

The Centers Concept calls a quarter-mile radius "core" of high density development, that is, 80 or more dwelling units per acre. The very high density of the cores, envisioned in the centers concept, may force high-rise configuration, which would severely limit solar access protection whether by the solar envelope or any other means.

Mr. Knowles' solar envelope concept allows most of the types of density of development encouraged by the centers concept, but as a rule not the level of density suggested in the core of the center. In referring to Table 2 of the USC report, it is evident that most of the designed buildings have a density of between 40 and 50 dwelling units per acre with 40 percent of the designs exceeding this number. These numbers match well with the density predicted for most of the area of Centers outside of the core. This can be seen in the following table:

Low-Medium	7-24 DU's/acre	Fringes of Centers; regional core suburbs near commercial areas
Medium	24-40 DU's/acre	Centers, suburbs near commercial areas and on some highways
High	40-80	Centers
Very High	80+	Cores of Centers

High density commercial space is difficult to create under the solar envelope concept because it is practically impossible to create without a high rise building configuration. If the rules that USC developed are followed, the numbers in Table 1 of their report are the results. Floor area ratios range between 2:1 and 4.75:1 with the average about 4:1. These designs were on moderate sized lots for commercial development, about 27,000 to 35,000 square feet. Parking is not considered in this floor area ratio calculation. These numbers are significantly below the 6:1 floor area ratio that the Community Redevelopment Agency of Los Angeles considers a realistic figure in the downtown redevelopment area. In most urban areas, the ratios obtained by the USC students would represent the low end of commercial development.

Professors Knowles and Berry established certain rules for determining an envelope in an urban area. If these rules are changed, density will also change. It should be emphasized that these rules were not the result of long, detailed, empirical studies but rather represent compromises to achieve the purposes of the student design classes. It must be remembered that the density of an area is entirely dependent on the degree of solar access desired. If a greater degree of solar access is to be guaranteed, density will fall. If a lesser degree of solar access is guaranteed, density will be allowed to rise. It has nothing to do with the method by which this solar access is guaranteed, such as covenants, restrictions, or even the solar envelope. In the USC solar envelope study a certain amount of solar access was ensured by the following rules:

a. 30% of an adjacent window wall may be shaded.

b. An entire fire wall may be shaded.

c. Public ways such as streets, alleys and sidewalks may be shaded.

d. If a building occupies less than 10% of the buildable area of the lot, it's considered to be a temporary building and may be shaded entirely.

If Rule "a" is changed to read a higher percentage so that 40%, 50% or even 75% of the curtain wall can be shaded, then this would dramatically increase allowed density by permitting all buildings that would shade curtain walls to be that much larger. Similarly if "d" were changed so that a building which covered 20 or 30 percent of a lot would still be considered temporary and not worth protecting then that many more surrounding structures could shade existing small buildings. The important point to be made is that there is nothing sacred about any of the four rules originally set by Professors Knowles and Barry, but instead they represent first attempts at rules which should be developed according to local conditions and objectives.

EXISTING HIGH RISE STRUCTURES AND SHADOWS

Structures built under the envelope concept within the shadow of existing buildings will face reduced densities to permit surrounding buildings to have solar access, while not enjoying solar access themselves. Some compromise may be possible. High rise buildings are spread throughout many areas of the City. A recent survey of commercial buildings for the San Fernando Valley showed several buildings of 18 stories, one 20-story building and numerous 10- and 12-story building and numerous 10- and 12-story buildings. Many of these buildings would create shading problems for newer buildings built under the envelope concept.

A 10- or 12-story building, assuming that it is approximately 140 feet in height, would have a winter shadow at 9:00 a.m. over 578 ft. long. This shadow would be reduced to 182 ft. at noon and return to 578 ft. at 3:00 p.m. This represents a worst case since the winter shadows (on December 21st) are the longest of the year. The shadow will also change rapidly in both length and position due to the movement of the sun across the sky. In spite of this, there will still be serious problems with those lots adjacent to a building either on the north, northwest or northeast. A larger building would have an even greater impact. It's true that any new zoning or planning code creates nonconforming uses and conflicts between existing buidings and new buildings. But, in areas where a great number of tall buildings exist, the solar access may be so reduced that it becomes a moot point. Under these circumstances, new construction might be exempted from solar access regulations, but this would have to be done on a case by case basis. The problem with this approach is that, in certain exemption areas, solar access would be effectively eliminated for the future because no new buildings would be built in conformance to the solar envelope.

If for some reason new areas of tall buildings were desired, then there might also be come exemption from the solar envelope provisions. One approach which has been examined in the Century City area is to enforce certain limits on the duration that a shadow can be cast on an adjoining building. The shadows of tall buildings move rather rapidly across the landscape. Assuming they are all tall and relatively thin, a shadow duration plan could be an acceptable alternative to the solar envelope. This is brought up only as an alternative without speculating as to where and why it would be applied. Specific studies would have to be done to justify such an exemption.

In most respects, the solar envelope is compatible with both the Centers Concept and the overall goal of greater energy conservation. Densities which are necessary for the Centers Concept to work area vailable using the solar envelope concept. Both housing and commercial space can be built to a density which supports the urban activities essential to the Centers Concept, with the possible exception of the cores of the centers. The envelope conept also promotes energy conservation by encouraging architects to build lower buildings with a higher volume to surface ratio. This is desirable becuase buildings with relatively less surface are more efficient in most cases. Finally, the envelope allows the architect to depend on the availability of solar energy to reduce the dependency on fossil fuels for heating and artificial lighting.

However, there could be some circumstances in which the solar envelope concept would not be compatible with the Centers Concept or sound energy conserving architecture. The available research is inconclusive. For example, existing high rise buildings generally use energy inefficiently. This may be the fault of the high rise physical configuration or the way the high rise building has been designed to date. The large number of windows on most high rises, if designed for energy efficiency could reduce the need for artificial lighting and therefore significantly reduce energy consumption. Two office buildings of the same basic design that represent significant advances in energy conservation are being built in cities as diverse as Los Angeles, California and Toronto, Canada. According to the Harvard Business School Report Energy Future the building in Toronto will use no more than 65,000 DU's per sq. ft. per year. Current energy conserving building codes permit buildings that use 135,000 BTU's sq. ft. year.

In conclusion, the solar envelope concept would not protect lots adjacent to the north of medium and high rise buildings, although mentioned previously other approaches would not protect them any better. However, there may be instances where there would be a net energy gain by allowing high rise.

AIR RIGHTS

There is another aspect of the Citywide Plan that may have to be modified with consideration to sunlight and solar access. One of the Plan's objectives is "to encourage the development of air rights over publicly owned rights-of-way in areas of high intensity where appropriate ..." Should these air rights be developed adjoining buildings would not be able to shade the right-of-way without shadowing structures over that right-of-way. In addition, the structures over the rights-of-way will cast shadows over neighboring buildings. One particular case of planned air rights utilization is the Central City Elevated Pedway Plan which encourages the development of elevated pedways within central Los Angeles. All new buildings must be designed to accommodate the planned elevated pedways. Some buildings in the central area already have been connected by elevated pedways. These pedways while considered an essential part of downtown development will cast shadows that may be prohibited under the envelope concept. Of course, this could be taken care of with a minor exception in the envelope concept.

The term air rights can also refer to the construction of buildings over public right-of-way, such as a high rise building over a boulevard or freeway. Professor Knowles' rules have no restrictions on the shading of public ways. If the air rights are utilized over these public rights-of-way, then solar access may be needed and the rules would have to be modified.

COMMUNITY PLANS

A brief review of Community Plans by the staff, reveals one conflict between the envelope concept and the Community Plans, the land use elements of the City. This is problem is one of not knowing what maximum density can be developed in any one area without knowing individual envelopes. The present practice allows for certain population projections to be accommodated within the planning area of each Community Plan. A Community Plan could conceivably call for densities great enough to accommodate a certain population but the parcel by parcel envelopes might not allow room for the planned densities. This could require preliminary envelope studies to be made during the preparation to any Community Plan. These studies could be replaced, or supplemented, by a computer analysis of the possible envelopes in an area that would give the planner an idea of an upper limit of densities. Another problem could be where the envelope would allow more density than called for in the Community Plan. Here, the solution would be to set an upper limit in terms of floor area ratio or dwelling units per acre. Buildings would not be allowed to exceed this limit even if the envelope would permit higher density.

A recent State mandate requires that the City bring its zoning into conformance with General Plan. In many cases, the zoning projections for density exceed those densities suggested by the Community Plans. For example, zoning on a group of properties may indicate a floor area ratio of 13 to 1 where the Community Plan calls for commercial buildings in that area not to exceed a floor area ratio of 6 to 1. This State mandate is being executed by the City in the near future, and may prove to be good opportunity to implement the solar envelope concept on a district by district basis. The densities discussed by Mr. Knowles may then become more realistic in many areas of the City, particularly in areas outside of the very cores of the centers.

THE ENVELOPE AND CCEMP

Some of the staff concerns about the congruence of the General Plan with the solar envelope concept may be answered by a study currently being undertaken by the City called the Comprehensive Community Energy Management Plan, or CCEMP. One of the results of this study will be an Element of the General Plan which plots Los Angeles' future for energy use and needs. The Plan is meant to answer some of the issues raised here about the relationship between buildings, transportation, waste heat recovery, industrial energy uses, and other energy related issues. The General Plan for the City consists of several parts, the Concept Plan declares the intent of the City Government toward the future form and long range development (approximately 50 years) of the City of Los Angeles. It is the basis for the more detailed portions of the General Plan.

The Concept of the General Plan lists several objectives and features that directly realte to certain physical configurations encouraged by the Solar Envelope. For example, the Concept suggests "the preservation of the low density residential character of Los Angeles except where density centers are encourged." Some of these relationships may be strengthened with the advent of the Comprehensive Community Energy Management Plan.

ADMINISTRATION

The complexities and scope of the solar envelope could create problems when applied to to every yard case, variance, etc. Staff analysis determined that if the solar envelope were applied uniformly for every case where the Planning Department had to make a decision, there could be as many as 6,000 envelopes calculations needed every year. The Planning Department annual report for 1978 listed 385 zone changes, 14 specific plans, 552 parcel maps, 632 tentative subdivision maps (for a total of 4,587 lots) 262 zone variance applications, 221 conditional use applications, 902 slight modifications and 125 interpretation cases filed.

It is likely that this volume would create a backlog, initially, for two distinct reasons. The first is that the envelope is different enough from existing planning tools that some learning time will be necessary. As planners become more familiar with the envelope as a tool, this problem may resolve itself. The second problem is that the envelope may be much more time consuming to deal with than the zoning regulations it replaces. If true, this problem will not go away by itself and could require additional staff.

Aside from hiring additional staff, there are other solutions. The development of a computer program to calculate the envelopes would be useful to the Planning Department staff, the Department of Building and Safety, and the private sector. Ideally, this envelope program would be available at the different public counters via graphic output on a video display. If other buildings were taken into account when designing the envelope, as Mr. Knowles suggests, then it would probably be necessary to determine these buildings shading effect manually. The alternative, of programming existing site conditions into the computer, would be impossible.

Another solution to this increased workload would be to exclude certain applications. This would be done most logically by exempting certain zoning categories. Los Angeles has a high a percentage of its land devoted to single-family homes. This type of building, because of its low density and increased flexibility on the part of the owner to use solar energy, might be better served by an easement or covenant. If these tools were applied unifrmly throughout a neighborhood, they could provide adequate protection and nearly eliminate the need for envelopes.

VARIANCES

In several of the interviews, it was suggested that the variance procedure be amended to specifically allow variances for solar utilization. This amendment would allow changes in setbacks, building lines, projections into yards, or auxiliary structures for the utilization of solar energy. The City Attorney pointed out that such a variance would still have to depend on finding of unnecessary hardship. The central issue is whether the denial of solar energy and its social and economic benefits constitute a hardship.

The procedure, as it stands now, has some flexibility. Section 12.27B of the Zoning Code prescribes that a Zoning Administrator has the power and duty to investigate and decide on all applications for variances. He may waive any of the requirements of the zoning ordinances slight modifications of yard and area requirements. However, there are certain findings listed in this portion of the Code that must be met before a variance can be granted. To be consistent with the City Attorney's judgement, the Planning Department should be aided by the City Attorney's Office in drawing up guidelines for evaluating "hardship" in denial of solar energy.

CITYWIDE VS. LOCAL APPLICATION

In any solar access issue, there are serious problems in deciding how widely a technique should be applied. Those interviewed, whose day to day job involved working with developers, saw problems with implementing the concept citywide. The solar envelope represents departure of magnitude and kind from the existing development practices. Their feeling was that the developers and the Planning Department needed time to adjust.

Other members of the Planning Department, including the Director, felt that it citywide application would be more equitable and would better promote the City's solar energy policy. Since there is little doubt that solar access is desirable and it is official City policy to promote renewable resources (mentioned in the City's Concept Plan and elsewhere), it seems desirable to provide solar access to all people, as rapidly as possible. Also, from a political point of view, it is sometimes as difficult to enlarge a "pilot" program as to implement a full scale program from the beginning.

BOUNDARIES

If implementation is done in a local community, there are problems in preventing buildings out of the area from shading the buildings within the area. For example, buildings to the south of the zone could be built to any height. Buildings within the site would be shaded even though they, themselves, would be built in conformance to the solar envelope. While the City Attorney doesn't feel this raises a serious legal issue, it is certainly inequitable.

There are three solutions to this problem. The first is to simply ignore it. This approach is used for existing, nonconforming uses. The theory is that some owners will be unavoidably penalized, but the impact will be minimal and more or less evenly distributed. That theory breaks down under closer scrutiny. When a developer buys a lot in the shadow of a nonconforming building he knows this in advance. If he builds close to the southern edge of the zone, he must assume that he may be shaded in the future, as a new building could be built at any time to block his access. This is in spite of the fact that he, himself, has built a conforming structure. The situation where all the property owners among the southern boundary cannot be guaranteed what they themselves have to provide for others, although not illegal, should be avoided if possible.

The second solution is to create a buffer zone. This would mean restricting the height of buildings to the south of the zone so that they would cast minimal shadows into the zone, itself. Since these buildings would only be restricted in casting shadows in one direction, they would be less constrained than if they were built under the solar envelope. This tiered effect is admittedly still inequitable, but it spreads the inequity over more property owners.

The third solution, and fairest where applicable, is to take advantage of natural or man made boundaries. For example, if a freeway existed to the south of a zone, there is little chance that buildings would cast shadows all the way acrosss the freeway and into the zone (of course the freeway itself could cast significant shadows, but these would be "permanent" and predictable). Other features, such as parks or wide boulevards, can also reduce the shading by normal buildings into the solar zone.

LOCAL IMPLEMENTATION STRATEGIES

If the City decides that it would be best to implement the solar envelope in a local area, it has several opportunities. One approach would be to use an area under the jurisdiction of the Community Redevelopment Agency. The CRA exercises a great deal of design control in its project areas and could easily write conformance to the solar envelope into the conditions of development. The City's Housing Authority also exercises similar control, and with increasing money for energy projects available from Federal sources, the agency might want to get involved in solar access application.

If the city wished to let the private market work with the envelope concept, it could use the city's existing historic preservation district ordinance as a model for organizing a "solar energy district." This concept was first suggested by Karin and William Hillhouse in "New Mexico's Solar Right's Act: A Cloud Over Solar Rights" published in the November-December 1979 issue of the "Solar Law Reporter". On page 757, they proposed a "Solar Energy District Act" modeled on New Mexico's Historic District Act. This would have similar requirements as far as legal findings by an overseeing group, certain incentives for private developers to negotiate with property owners for mutual protection of solar and other property interests, contract zoning procedures, systems of transferable development and/or solar access rights, and other regulations to insure the smooth development of solar energy and protection of solar access.

COST OF VERIFICATION

The cost of envelope verification will vary widely depending on the degree of verification that the City wants to have. With the existing code, a developer can ask the people behind the counter what densities are possible, but under the envelope the developer will have to calculate the envelope in order to determine exact densities. In spite of this, the planners at the public counter may be able to give rough estimates of densities after gaining experience with the envelope. It also should be noted that this problem is most serious in commercial areas. All structures in residential areas must be designed to insure full lot access for surrounding residential lots. This requirement makes residential envelopes easier to determine.

It is not clear whether the City would have to confirm each envelope graphically or could review the calculations done by a licensed civil engineer. This latter approach is now taken by Plan Check for property surveys. Measurements are submitted by Civil Engineers and Plan Check generally reviews the procedure. According to the City Attorney's Office, California Code sections 818.6 and 821.4 limit City liability caused by not catching errors made by private parties. Though the legal liability for incorrect verification appears to be limited, it is still in the City's best interest to catch errors before structures are built; few judges are likely to order demolition of a whole building just because casts an illegal shadow on a neighboring structure.

The degree of verification that the City requires will be mostly determined by administrative considerations. If the solar envelopes need only to be plotted in a very general way to understand solar access availability in community plans then the costs may be minimal. On the other hand, if the City Planning Department determines a need to calculate envelopes on a site by site basis, then the costs could be substantial. Any costs could be reduced by a computer program.

ENVELOPE, DENSITY AND CHANGE OVER TIME

The change of an envelope as the buildings around it change is one of the most interesting aspects of the solar envelope concept. One factor, the shading of a certain percentage of a window wall, means that the envelope becomes a dynamic structure over time instead of a fixed construct. As the window walls to the north, northeast, and northwest of the structure grow in size, then the envelope for a given site will also grow in size. This factor combined with other site specific characteristics such a fire walls can create problems from an administrative point of view. In traditional planning, a population is projected for a given land area. This land area is then zoned to contain this population in terms of commercial and residential density. It is assumed that over time this area will reach this density and level of use. This level of use guides the emplacement of the service systems of the City such as streets, sewers, communication lines, etc. as well as affecting larger regional issues such as regional transportation plans, housing plans, and other regional plans. If it's admitted that properties, instead of having ultimate densities placed on them, can grow endlessly, constrained only by the surrounding structures, then it becomes much harder to plan the placement of the infrastructure. Alternatives to endless growth in commercial zones could be explored such as keeping an upper limit on land use in terms of density even in areas controlled by the envelope. This provision would state that a building developed within th envelope could still not exceed a certain floor area ratio. That way that ultimate floor area ratio could become the basis of the urban infrastructure.

This linking together of urban density projections and planning caused the most amount of dissension among those interviewed about the Knowles concept of the solar envelope. The resolution of these differences is critical to the application of the solar envelope in commercial areas and must be explored thoroughly. The USC approach used a variable envelope dependent on local surroundings for several reasons:

1. If a structure is permitted to shade certain percentage of the curtain wall of an adjacent structure instead of not shading it at all, then densities can be significantly increased. The 30% figure was arrived at as a compromise between shading and allowing most of the structure to still have solar access for thermal conversion and natural lighting.

2. By giving this number as a percentage, the envelope changes over time. It was felt by use that this would allow the urban form of the city to also change over time; to grow in areas that were expanding in density. If this percentage figure was replaced by a fixed height above street level, say two stories, then the envelope would become a fixed construct, over time, and not dependent on the size of an adjacent curtain wall.

3. By making the structure respond to surrounding architecture there is the opportunity for maintaining the prevailing urban scale in an area. Under the Knowles' regulations, it's impossible to build a 20-story building adjacent on the south, southeast, or southwest of a smaller five or eight-story building. This enforcement of an overall urban scale is a powerful urban design tool, recognized in many planning areas around the United States.

4. By relating the solar envelope to existing surrounding structures, the likelihood of explosive real estate development is reduced considerably. This would tend also to reduce rapid land development and speculation and preserve older, smaller buildings as economic uses of a given piece of property.

The limitations on abrupt changes in scale, mentioned in point 3 could provide for slower, more orderly growth in an area, but also could preent the rapid rehabilitation or redevelopment of a low density, blighted area. The effects of this two-edged sword would have to be studied further. To implement the envelope, as outlined by USC, field surveys would have to be done in every Planning district to get a general idea of possible densities. This would increase the burden on the City Planning Department, and zoning code enforcement by the Department of Building and Safety would be made much more difficult.

SUBDIVISIONS

As a result of the passage of the Solar Rights Act of 1978 by the California State Legislature, the City of Los Angeles is requiring that all subdivision applicants submit a report prepared by a licensed engineer or solar systems expert on the passive Solar Energy Systems to be incorporated into the tentative tract application. The policy language in the law requires no specific action by the local government agencies. In the interview with the Deputy Advisory Agency solar feasibility reports for subdivisions were mentioned. The staff has reviewed several of these reports and finds most of them inadequate. The staff suggests that the City Planning Department develop precise and stringent guidelines for the submission of these reports and that analysis cover not only the subject site but also all effects on adjacent sites. The Department has developed guidelines as of November 1979. They do not as yet have the force of an ordinance. The City Attorney's Office and the City Planning Department are working to further refine these guidelines.

"TENT" SOLAR ACCESS PROTECTION

A solar envelope is relatively complex to determine when compared with other forms of access protection. It is difficult to draw, particularly for the first few times. It is also difficult to "visualize" by those not trained in three dimensional design. A typical architecture student at USC spent 12-16 hours on his first envelope attempt. This time was reduced to 4-8 hours after some experience. If the City didn't want to place this burden on all property owners, it could consider protecting some zoning types (R-1 for example), by some alternative means.

One of these alternatives is the tent or plane approach, which was used in the Wilshire Park Mile area. The concept of a tent or plane approach for solar access was discussed in the interview on the Park Mile Specific Plan. The Planning Department arrived at a plan where a line was projected from the top of a 20-ft. wall on the north side of the property, southward at an angle of 30 degrees. This line was supposed to approximate the angle of the sun's rays at the winter solstice. The advantage to this was that it was a fairly easy, straightforward approach. It is true that this approach is simpler than the approach taken by Mr. Knowles. It is, in fact, not that dissimilar from the bulk plane provisions in many zoning codes (such as the New York City Zoning Code), expressed through a series of set backs. For example, the building must set back 5 ft. for every 2 ft. it goes up. This is quite practical in many areas of the City, particularly those that are relatively open and flat where the streets are oriented along cardinal points of the compass.

The solar envelope gains an advantage when these conditions are not met, or when property becomes irregular in shape. The movement of the sun creates shadows on the east and west sides as well as the north side of a building. These shadows are not accounted for in the simplified 30° angle projected on the north side of the building alone this can cause problems. When other buildings surround the site in commercial areas, the simple 30° angle rule cannot protect these other buildings. Finally, when the property does not lie on the cardinal points, then the geometry of solar shading changes entirely and the 30° angle on the most northerly side may not even closely resemble the angle of the sun's rays.

The "tent" approach would involve less cost to the City and to the developer than the envelope. Estimates of envelope surveys by Civil Engineers range in the neighborhood of from 300 to 600 dollars depending on the complexity and surrounding site conditions. While this would certainly represent a substantial cost for private homeowner involved in some sort of yard case or addition to his own home, this is not a major expense for a developer developing multi-family housing or commercial property. Even acknowledging that this 300 to 600 dollar figure could be low for complex envelopes, all indications are that the money spent to design the envelope would be minimal compared to the other survey costs that range between $3,000 and $6,000 per site for a normal 10 or 15 unit condominium project.

PHYSICAL DESIGN

Many of those interviewed were concerned that the solar envelope concept would significantly change the city, as we know it physically. Overtime, this is probably true. The question is whether the changes are desirable or undersirable; whether changes will provide a better or poorer physical environment. From an administrative point of view, some of these changes could cause problems. One interviewee states that under solar envelope zoning there isn't a consistent setback, an "advantage" of the code now. There is a precise setback and people know where they "stand". If the setback varied from lot to lot, then the unprofessional applicant would have problems and confusion. There are also traffic and safety problems with varying setbacks or larger envelopes on corner lots.

The Solar Envelope Concept combined with a desire on the part of most developers to develop to the maximum density on their site would change the physical appearance of the city. As the student designs show, the tendency is to build a building with angled sides following the side of the envelope and with the maximum bulk of the building at the base. This gets the maximum amount of developable volume, especially, at the street level. Whether this would cause the "really bizarre pattern of development" one staff member mentioned is a matter of opinion and personal taste.

The urban design problems are complex enough that a single community designed under the solar envelope concept may be needed before a detailed analysis can be done. Some areas of the city now have zero set back lines and the economics of development force buildings to the perimeters of the block. The Solar Envelope Concept would force these to "set back" as they go up, and allow more light and air onto the street than is presently the case in zero setback areas. Ground level space could be reduced in many residential developments, but there is a greater opportunity for terraces and open areas above the street level. In dense urban areas, these may be more desirable due to traffic noise and conjestion at the street level.

The solar envelope concept will create a physical environment which is consistent with the original goals of zoning. Zoning was first enforced to separate land uses and for public health, safety, and welfare. Many zoning ordinances include language about encouraging light, air and reduction congestion in those areas where conjestion seems to be detrimental to physical well being. The solar envelope concept, with its angling back away from the street is very reminiscent of the set backs enforced in the New York City zoning law. The purpose of this was to specifically allow light and air into the streets of Manhattan. While the solar envelope concept calls for a change in our attitude about the way zoning is enforced, it may still very be effective in furthering the original "quality of life" goals of zoning.

ECONOMICS

Many of those interviewed were concerned about the ways in which the solar envelope would affect the economics of development and City administration. Development and administration costs will be driven up in two ways, directly and indirectly. The two direct ways that costs will increase is by increased administration costs on the part of the City, which will be reflected in higher City fees, and increased charges by civil engineers and architects to establish the envelope for the developer. The two indirect ways that costs will be driven up will be restrictions on development (this could include reduce density, increased underground parking, etc.) and increased architects' costs to design around stricter parameters. All of these costs, except for the fees imposed by the city, will, over time, be minimized by competition among architectures and engineers.

The increased costs of the solar envelope must be balanced against the energy costs that the citizens of Los Angeles will have to face in the coming years. These energy costs have been rising substantially. For example, natural gas has increased over 100% in the last eighteen months. These costs will keep rising for the foreseeable future. Not only does this cause economic problems for the citizens of Los Angeles, but because much of this money is exported from Los Angeles and even Southern California, this can cause severe economic problems for the entire region. Finally, increased energy costs affect different segments of the society in different ways. Low-income families and elderly people living on fixed incomes are particularly affected. The solar access protection process is a slow process and the City must begin now to insure the future economic viability of energy conservation and solar development.

VI. ENVELOPE APPLICATION TO THE WILSHIRE PARK MILE AND ENCINO SPECIFIC PLAN AREAS

A. WILSHIRE PARK MILE SPECIFIC PLAN

The Wilshire Park Mile area presents the sort of zoning problems typical of former low density areas now subject to strong development pressures. Wilshire Boulevard in this area is being developed to high density residential and commercial uses, while single-family homes occupy all the immediately adjacent streets.

Wilshire Boulevard, running fifteen miles from downtown Los Angeles west to Santa Monica and the Pacific Ocean, forms one of the major east-west circulation spines of the City. The Park Mile section, designated as a "Specific Plan area" extends from Highland Avenue on the west, to Wilshire Place on the east and extends one block north and south of Wilshire Boulevard itself.

There are several areas of Wilshire that are already characterized by high density development (Westwood, Beverly Hills and downtown) and the trend to higher density development is already established in additional segments, such as the mid-Wilshire and Vermont Avenue areas. As these medium density areas have become more fully developed with large commercial and residential buildings, conflicts with the nearby existing residents have arisen.

The residents of the older single-family homes are concerned about a number of potential negative effects upon their property, among which is decreased access to the sun.

In reaction to strong citizen concern, the City Planning Department drew up the Wilshire Park Mile Specific Plan. This Plan would partially protect the solar access of the property owners adjacent to new development on the northern side of the Boulevard, as indicated in the following excerpt from the Specific Plan Ordinance:

ORDINANCE NO. 152,471

EXCERPT

"So as to minimize shade and shadow impacts, impacts on the peace, enjoyment and privacy of adjacent single-family residences and to provide for a smooth transition in scale, no building on the northerly side of Wilshire Boulevard may extend in height above a plane inclined toward the southerly sky upward at a 30-degree angle from a horizontal line 20 ft. above curb level at the northerly lot line. In addition, no building may exceed three stories or 45 ft. in height as measured from the curb, except that:

1. No building may exceed four stories or 55 ft. in height, as measured from the curb for those areas within Fire District No. 1; and

2. No building may exceed six stories or 72 ft. in height, as measured from the curb for those areas as described in Paragraphs (a), (b), (c) and (d) of Subdivision 2 of Subsection B of Section 3 of this Ordinance."

Park Mile Specific Plan Solar Access Provisions ("Tent")

The above-described shape is a simplified form of solar envelope, known as the "tent". Its essence is No. 1 below. Combined with other regulations, it results in the following limitations on building bulk:

1. Top enclosure may slope up to the south 30 degrees from a line 20 ft. above north wall grade.

2. North structure wall must be at least 15 ft. from the northerly property line to provide rear yard.

3. Side yards must be at least 10 ft. wide.

4. Height limit - three stories or 45 ft.

These controls were used as the foundation for analysis of the "tent" in comparison to the envelope.

Case Study Procedure

Numerous individual models were built and studied by USC for the SERI Grant. It would be redundant to perform the same tasks in this report. Staff decided to look at the Specific Plan area alternatives to the USC envelope and use a simplified "sun machine" method of analysis, (Figure 1-a).

Three lots were chosen for evaluation. One, on the northwest corner of Wilshire Boulevard and Lorraine Street, is rectangular with north-south orientation, (Figures 3 and 4). The other two are on angular lots on the north side of Wilshire Boulevard between Muirfield and Rimpau Streets, (Figures 5 and 6).

Plot plans of the chosen areas, scale 1 in. = 50 ft. were obtained. Wood models to the same scale were made as follows:

A - as proposed in the Specific Plan, "tent" within 45-ft. height limit, etc.

B - three-story height limit, conventional building, no solar controls.

C - like case A, but without height limit.

D - solar envelope, as defined by USC study.

The definition of residential solar envelope is the largest buildable volume over a site in which a building constructed therein would cast shadows on adjacent properties no greater than those cast by an 8-ft.-high fence at all adjacent property lines, from 9 a.m. to 3 p.m., all year.

The Solar Envelope is thus defined by the shadows it cast. One works backward from the maximum allowable shadow to determine the building shape, (whereas the tent is a description of building shape, which may cast various shadows depending on the orientation). The diagrams for the solar envelopes are the same for summer and winter because we did not project a building, but instead gave the "worst case" for the envelope. A building constructed under the solar envelope constraints would cast a shadow equal to or less than those shown.

"Sun" positions of 9 a.m., noon, 3 p.m. on the winter solstice (December 21) and the summer solstice (June 21) were chosen as the extreme conditions of shadowing with each of the case models centered on the solar beam, shadows were recorded directly on the plot plans. The results are shown in Figures 3 through 6, reduced to a scale of 1 in. = 100 ft.

Sections of these four cases are shown in Figure 2.

Starting from the buildable area (foot print) shadow outlines are identified by the time of day and time of year. For example, 9 A-W indicates the shadow boundary formed at 9 a.m. on the winter solstice (December 21). The morning shadow simultaneouly contracts and rotates toward the noon position of minimum shadow, thereafter expanding and rotating toward the afternoon position. The shadow is continually moving. The narrower the structure casting the shadow, the shorter is the time that any neighboring feature is blanketed by that shadow. Figure 8, since it contains both summer and winter extremes with a simple structure, also demonstrates the slow, secondary shadow rotation due to the seasonal change. For example, starting with the morning shadow on the winter solstice, each subsequent morning finds the shadow moving toward the summer position as well as moving with the hour of the day. (Summer and winter sun angles are also shown in Figure 1-B.)

SITE 1: NORTHWEST CORNER OF WILSHIRE BOULEVARD AND LORRAINE STREET.

A comparison of five diagrams under winter conditions (the more restrictive) illustrates several points. To begin with one extreme, Figure 8 shows the shading impact of high-rise development. Shadows are cast great distances over almost all of the block to the west of the structure and crossing Lorraine to the east of the structure. When the shadow is the shortest, that is at noon, the shadow still shades the adjacent property to the north and beyond into a second tier of properties.

The solar envelope (Figure 3-D) is the other extreme. This shadow is cast beyond the property on the west and north sides only a few feet, but is allowed to cross Lorraine Street to the east.

Figure 3B offers a medium degree of access where property to the west is shaded very little, but property to the northwest and north is shaded a great deal. Again, Lorraine Boulevard is shaded, but this shadow barely reaches into the property east of Lorraine. This may represent a "worst case" for the residents immediately to the north of the structure. With the three-story structures, adjacent properties to the north, are shaded throughout most of the day, unlike the narrower six-story building which would shade more of the property, but for a shorter period of time.

Case A (Figure 3-A) shows how much solar protection can be gained with relatively simple restrictions on developable area. The 30-degree angle reduces the shadows cast to the northwest, northeast and north of the building. Significantly, more than half of the lot to the north of the structure is not shaded at all. It should be remembered that the winter solstice would represent the maximum shading and the lot would be shaded less at any other time of the year. It is also of note that if the change were made to unrestricted height, (Figure 3-C) the major shading impact would be on the property to the northwest. Even so, very little additional shading would occur when taking into account shadow duration. In this case the height is doubled, but the usable floor area is increased only about 40 percent. This is because the 30-degree angle imposed on the north face of the building cuts into the building as a peaked roof would cut into an attic's usable area.

In considering solar access during the winter months, coventional three-story development would seriously shade the structure to the immediate north of the site. It does not reduce shading a great deal to place a height limit on the structure as long as the 30-degree angle is maintained. The "tent" creates an upper height limit automatically.

In summary, it is remarkable how much solar access can be given to the structures to the north and northwest of the site by the simple 30-degree shading rule.

SITES 2 AND 3: THE NORTHEAST CORNER OF RIMPAU AND WILSHIRE BOULEVARDS; AND THE NORTHWEST CORNER OF MUIRFIELD ROAD AND WILSHIRE BOULEVARD.

A brief review of the winter condition on these sites (Figure 5) shows a different picture of solar access from that of the preceding site. Because the property lines do not run due north-south and because the sites are irregular, the shadows form a more complicated pattern. This is true even though the buildable area remains the same at about 50 percent and the same setback and tent rules are followed.

If the total area of the winter shadow determines the "worst case" then the three-story conventional structure, Figure 5-B, is the worst case of those illustrated. In each case on Site 2, the noon shadow almost entirely covers the site to the north. Sites to the northeast and to the northwest are also seriously shaded in the morning or afternoon. On Site 3, similar problems occur.

The six-story modified structure, Figure 5-C, causes similar problems because of extremely long shadows and the complex shading patterns set up by two adjacent six-story structures.

What is of interest on these sites is that the shadows cast by the two cases using the modified 30-degree solar access plan, Figures 5-A and 5-C, still show very significant shadow impacts. In both cases, there is serious morning shading of properties immediately to the northwest of the two sites and shading across both Rimpau Boulevard and Muirfield Road at some time of the day. Furthermore, there is significant shading of the lot that lies between those two lots. This lot is being caught in a type of shadow crossfire. While the noon shadows are certainly smaller than traditional three-story developments would create on this site, they are still sizeable.

The large proportions of both of these buildings dictate that both northeasterly sites would be denied most solar access in the morning hours. In order to remedy this problem, angles would have to be cut out to the other sides of the buildings, aside from those pointing in the northerly direction. This would result in shadows being cast less deeply into other properties. It would also increase complexity.

In Figure 5-D with the solar envelope, the advantages are obvious. Again, very few shadows are cast to the north of either site and while shadows are cast due east or due west, they are cast no farther than about 10 ft. beyond either Rimpau Boulevard or Muirfield Road.

This is because the solar envelope, by definition, may not cast shadows beyond those that would be cast by an 8-ft. fence at the property lines. Density limitations, on the other hand, would be severe. It should be remembered, when comparing the small sections, that only in Case D must the sides of the building be sloped back, as well as the rear wall.

DIFFERENCES IN THE WILSHIRE SITES

Why do these differences occur so dramatically between Site 1 and Sites 2 and 3? There are two reasons. The first is that using the fixed 30-degree angle on the north side of the building as a tool for solar access gives little or no protection to lots on the east and west. The buildable area, the geometry of the property and the fixed front and back yards of Site 1 create very wide side yard conditions; so this is not a critical flaw if the height is restricted to three stories. On Sites 2 and 3, where the geometry of the sites change and where the side yards become much narrower, the "tent's" shortcomings begin to matter significantly.

The second reason for the difference is the non-perpendicular property lines on Sites 2 and 3. The 30-degree angle, when it is facing due north, creates a minimal impact on the property to the north. On the other hand when the front of the building that has the 30-degree angle cut in it is not facing due north, (as is the case on Sites 2 and 3), the northeast corner of each building begins to get exaggerated and shadows are cast farther off the site. What has occurred is that the geometry determined by an ideal north-facing wall is shifted off axis. While on Sites 2 and 3 this helps slightly in the morning, it does less well at noon and by 3 p.m. there is a serious shading problem. To solve this problem, both the northwest and northeast corners of the building would have to be removed. This would create a very elementary envelope, similar to what Mr. Knowles has suggested.

Another way of overcoming this shortcoming of the "tent" alternative is by specifying that the 30-degree angled plane would be projected from a 20-ft. wall on all property lines having any northern "exposure". The disadvantage would be added complexity.

Observations

A significant improvement in reduced shading of the residential area to the north is evident under the terms of the Park Mile Specific Plan Ordinance, (Case A).

The most practical, if not conventional solution to the problem of increasing usable floor space in commercial usage without aggravating shading is to go underground with at least one or more floors. Such an approach would have an additional benefit in that undergrounding is a very effective energy conservation measure, both for heating and cooling.

Should the envelope be applied to the Park Mile Plan area, the following points should be remembered.

1. Under the envelope the more severe height limit restrictions would be on the north side of Wilshire Boulevard rather than the south side.

2. Northerly residential properties all have east-west orientation. Thus they have no real flexibility to move on the lot to avoid the shadows from adjoining commercial buildings.

3. The southerly R3 development could shade the commercial properties to their north, but the commercial seems of sufficient depth to avoid a major impact if parking is placed to the south or if the apartments are placed as southerly as possible within the Specific Plan area.

4. The R1 and R3 properties would tend to be consolidated into larger lots because of the problem of envelope in the east-west direction.

5. The southerly side of the street would be more valuable under the zone, as well as the corner lots.

To assist the reader in visualizing the effects of the solar envelope, isometric sketches are shown on Figures 7-A and 7-B.

Photographs

As a followup to the sun-simulator exercise for Park Mile shadowing, shadows from some existing high-rise structures were photographically recorded for the purpose of estimating the extent and impact of new development. The following photos illustrate an average condition of shadowing rather than the extremes.

Plates 1 through 5 show single-family residences adjacent to the north side of the Park Mile commercial area. These residences are elegant two-story structures, individually designed, perhaps 30 to 40 years old. Mature trees and dense shrubbery now generally shade their southerly side, to the extent that the structures are rather well hidden.

Plates 3 and 6 show recent high-rise structures on the north side of Wilshire Boulevard which are generally confined to parcels immediately fronting on Wilshire Boulevard, with the lot immediately north or behind developed for parking. As shown in Plate 6, the northerly shadow extends less than half of the parking lot width.

It is significant that the Specific Plan Ordinance requirement will generally minimize shadowing of residential areas, but also will limit commercial floor space per structure if the structures are confined to the first tier of lots (see Plates 7 and 8).

Plates 9 through 12 illustrate other interesting special situations in the Wilshire Park Mile Plan area.

SUMMARY: WILSHIRE PARK MILE STUDY AREA

After evaluating the different methods of solar access and judging them by their simplicity and the degree of solar access protection they afford, there is no clear winner. The City's effort at a simplified solar tent forces an improvement in solar access over traditional development. It also seems that the City's height limit makes a certain amount of sense even though a taller thinner building could provide some advantages to a shorter wider building in duration of shadow. In fact, the City's present solution seems to be quite satisfactory for those cases where lots are set out at right angles to Wilshire Boulevard.

In many cases streets do not join Wilshire Boulevard at right angles and the lots are shifted off of the grid. In these cases the City's regulations about the 30-degree slant from the north wall produce less satisfactory results. The adjacent lots to the immediate north of Sites 2 and 3 still have shading problems.

One way of solving this problem would be to further modify the City's regulations. A possibility would be to change the regulations having to deal with the imaginary 20-ft. wall by:

1. A lower wall, such as 10 ft. or 8 ft.

2. Generating the 30-degree plane from imaginary walls on all property lines having a northern exposure.

Another approach should be to restrict the buildable area even more. In cases where the building is very tall and thin, such a reduction of the buildable area could be compensated by an increased height limit. This shadow might move quickly enough across the landscape so as not to impact any one dwelling significantly, especially those some distance from the building.

On the other hand, if needed density became an issue, one approach would be to waive some of the City requirements such as parking or front setbacks. In some cases, even side yard setbacks could be waived where the development to the east and west of the new project go partially underground for either parking or some of the support systems for the residential areas, i.e. laundry rooms, etc., this would increase the floor space at the developer's disposal. It should be mentioned in passing that underground buildings provide some energy conservation advantages because of the insulating qualities of the earth. However, this is not usually an important consideration in Southern California because of the mild climate.

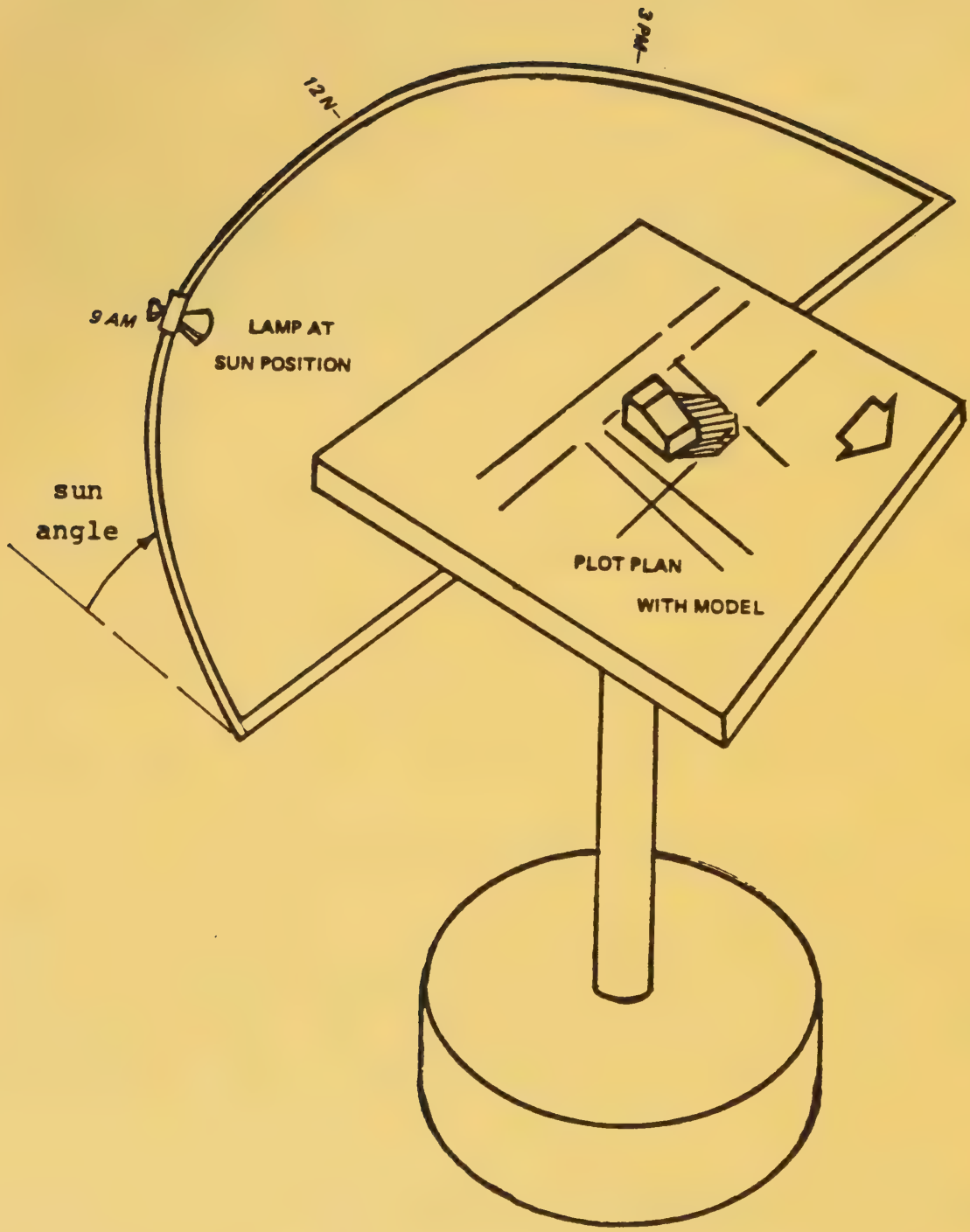


FIGURE 1a

SOLAR SIMULATOR

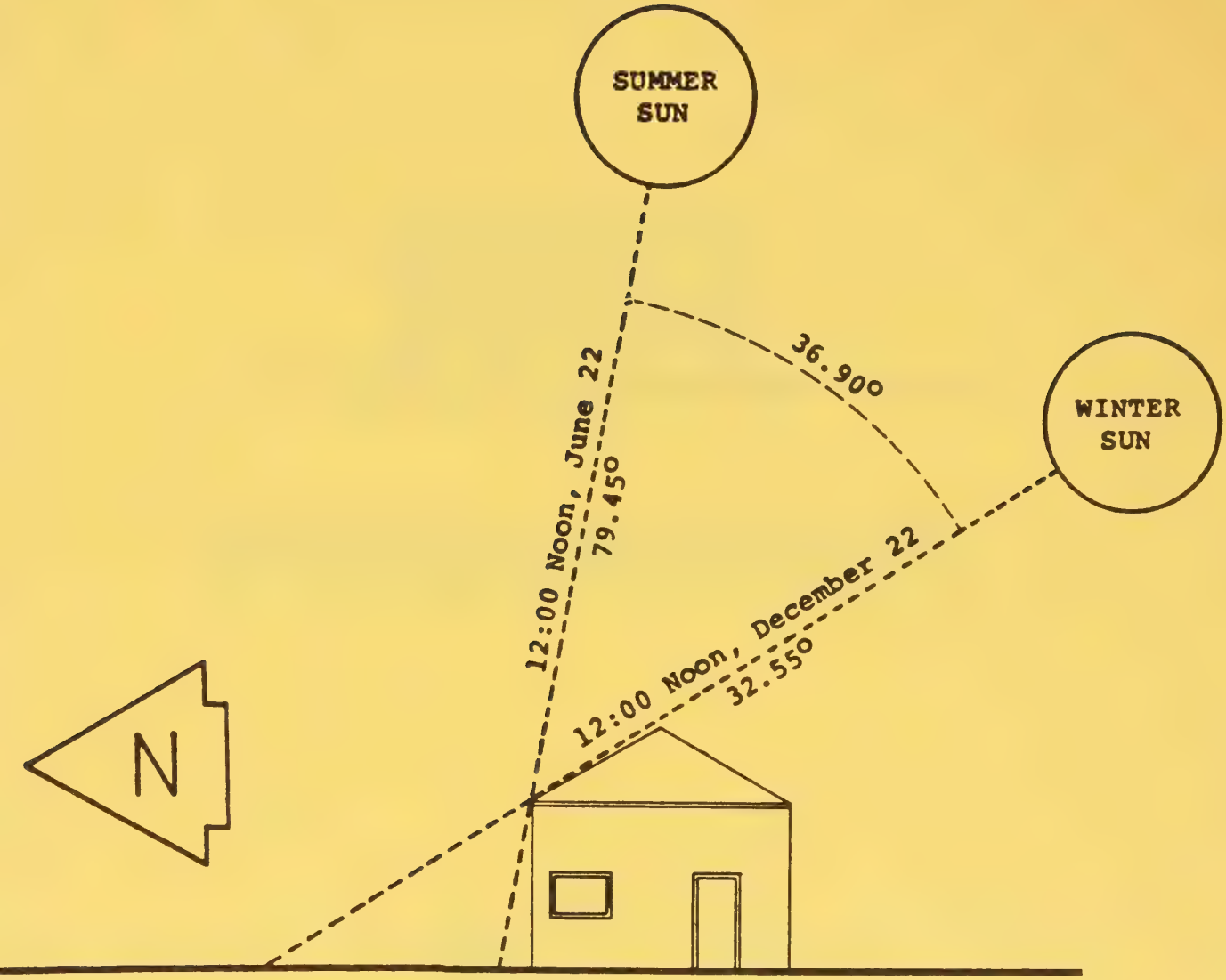


FIGURE 1b: SUMMER AND WINTER SUN ANGLES

FIGURE 2 (BOTH PAGES)

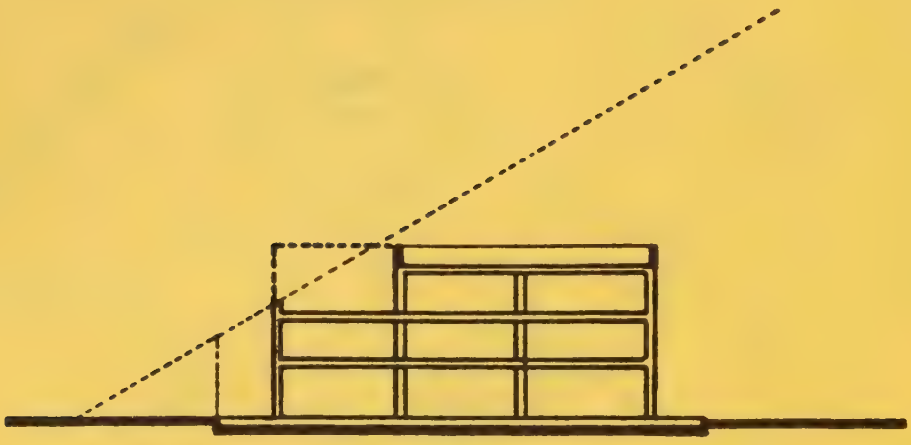


FIGURE 2-A: "TENT" WITH 45-FOOT HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.

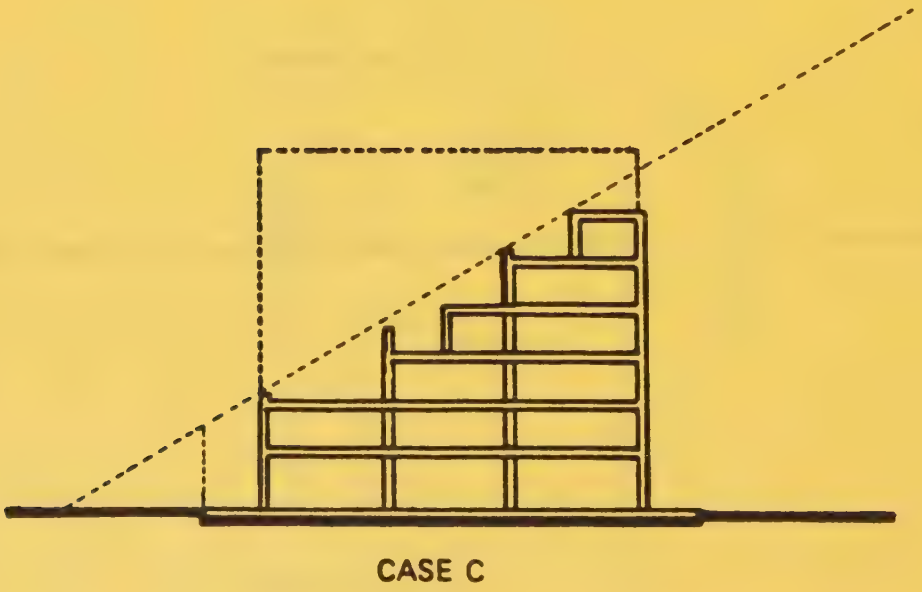
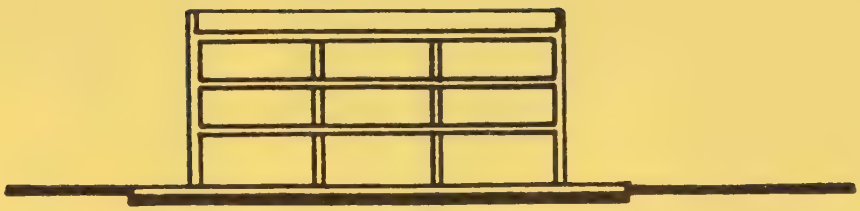


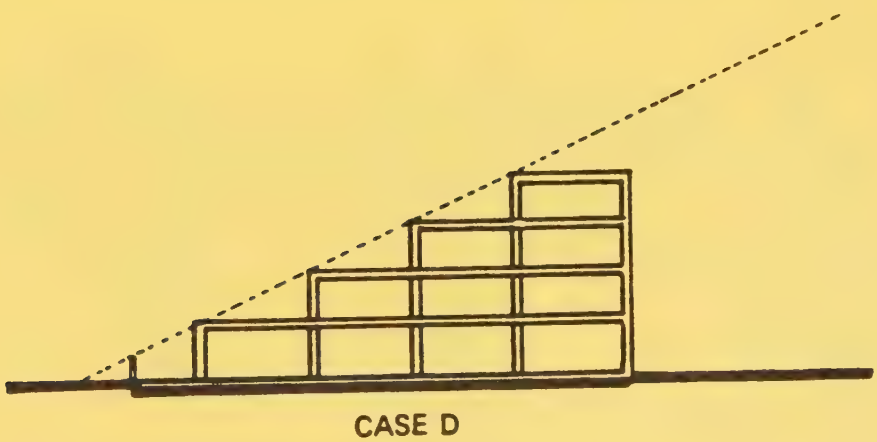
FIGURE 2-C: "TENT" WITH NO OTHER HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.



CASE B

FIGURE 2-B: 3-STORY CONVENTIONAL

45-foot height limit, standard setbacks, no other controls.



CASE D

FIGURE 2-D: SOLAR ENVELOPE

May not shade beyond 8-foot fence at adjacent property lines, 9 a.m. to 3 p.m., all year.

FIGURE 3 (BOTH PAGES)

Winter Shadows, Site 1

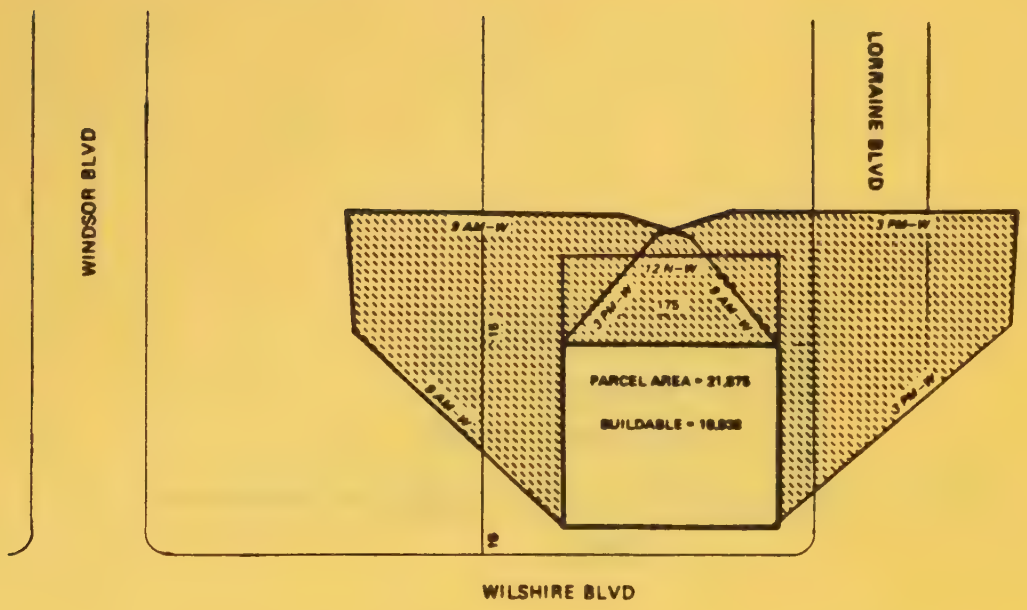
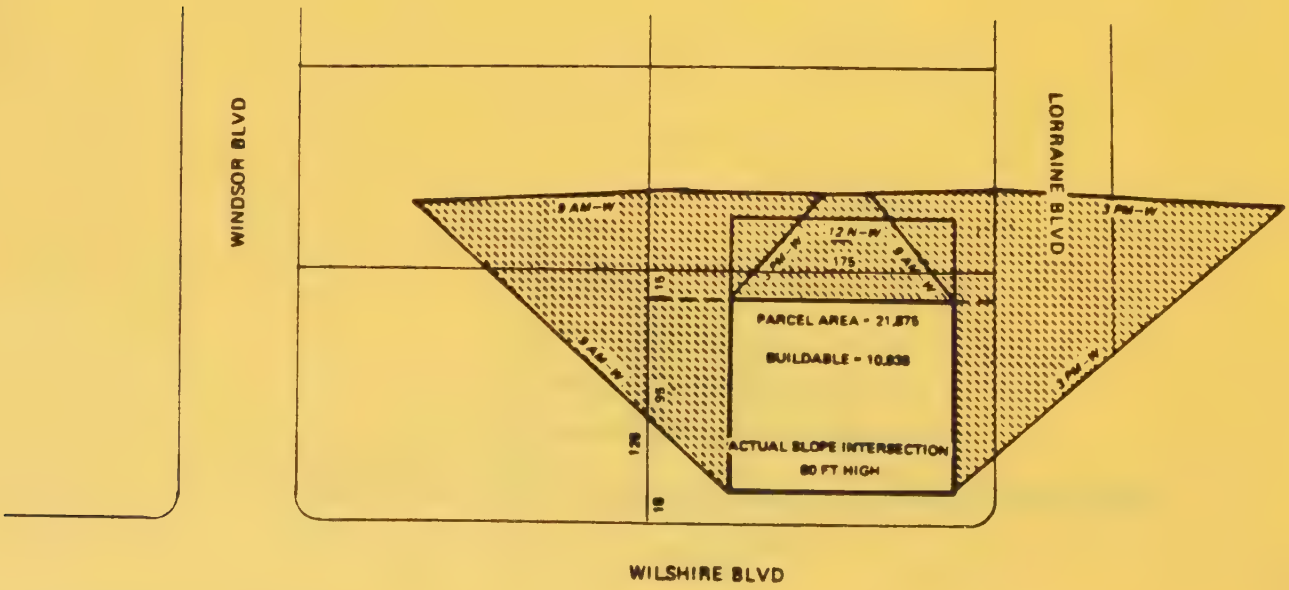


FIGURE 3-A: "TENT" WITH 45-FOOT HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.



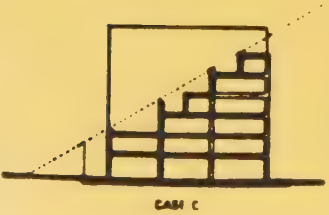


FIGURE 3-C: "TENT" WITH NO OTHER HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.

ALE: 1" = 100'

all sections for conceptual
ference only; not to scale.

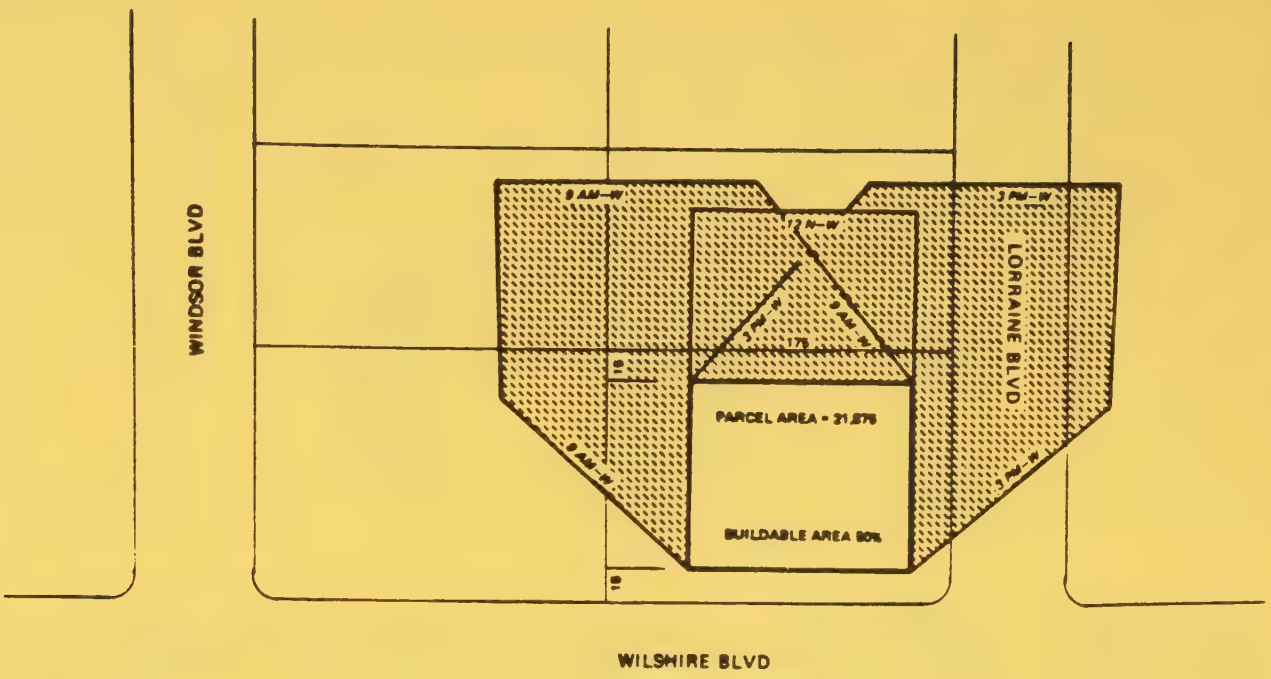


FIGURE 3-B: 3-STORY CONVENTIONAL

45-foot height limit, standard setbacks, no other controls.

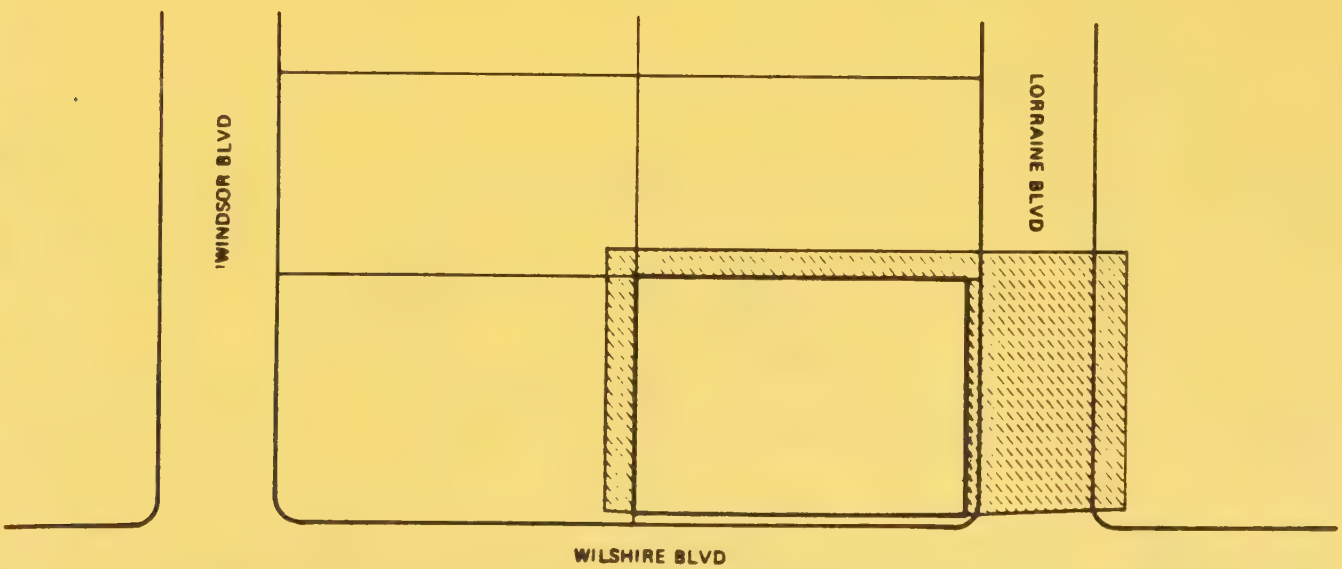
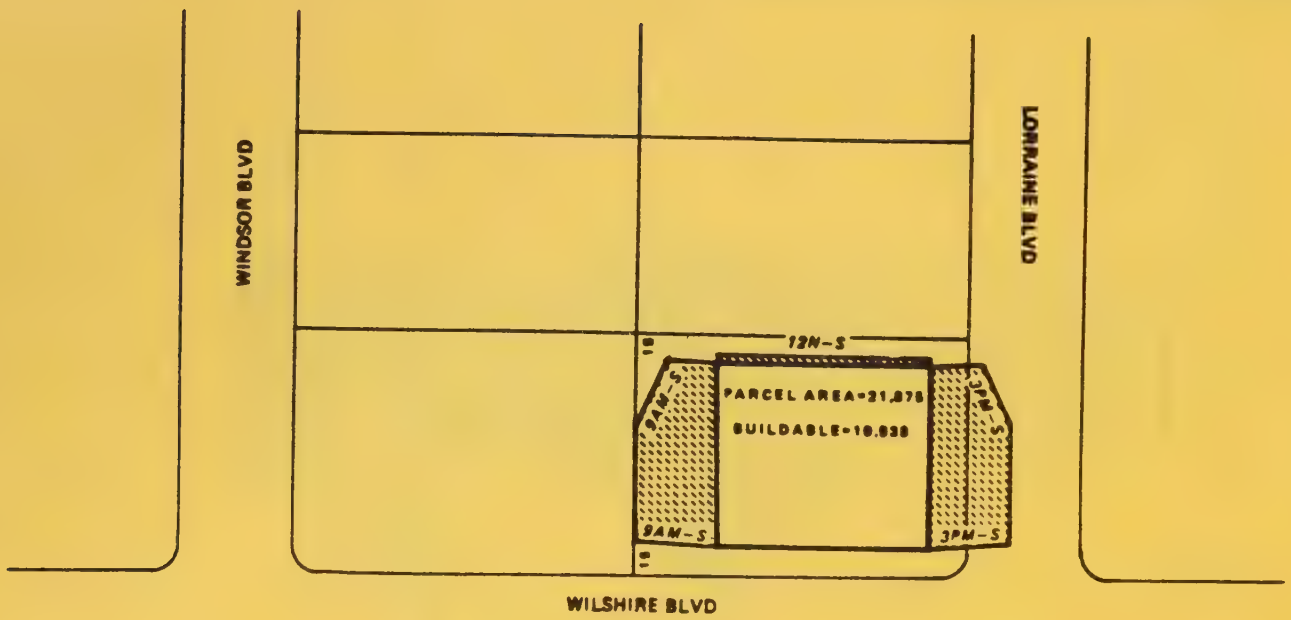


FIGURE 3-D: SOLAR ENVELOPE

May not shade beyond 8-foot fence at adjacent property lines, 9 a.m. to 3 p.m., all year.

FIGURE 4 (BOTH PAGES)

Summer Shadows, Site 1



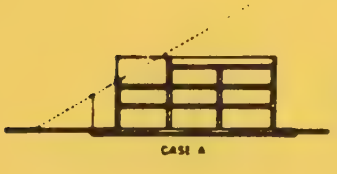
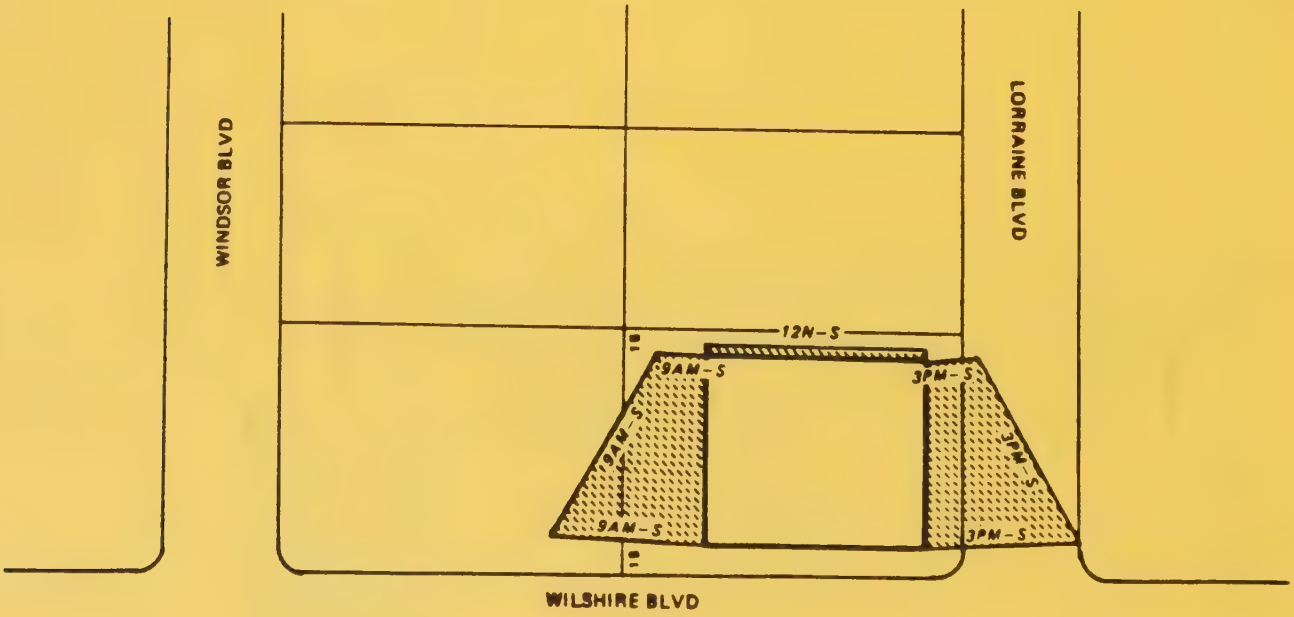


FIGURE 4-A: "TENT" WITH 45-FOOT HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.



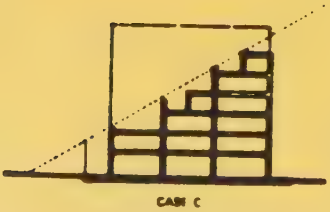


FIGURE 4-C: "TENT" WITH NO OTHER HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.

SCALE: 1" = 100'

mall sections for conceptual
reference only; not to scale.

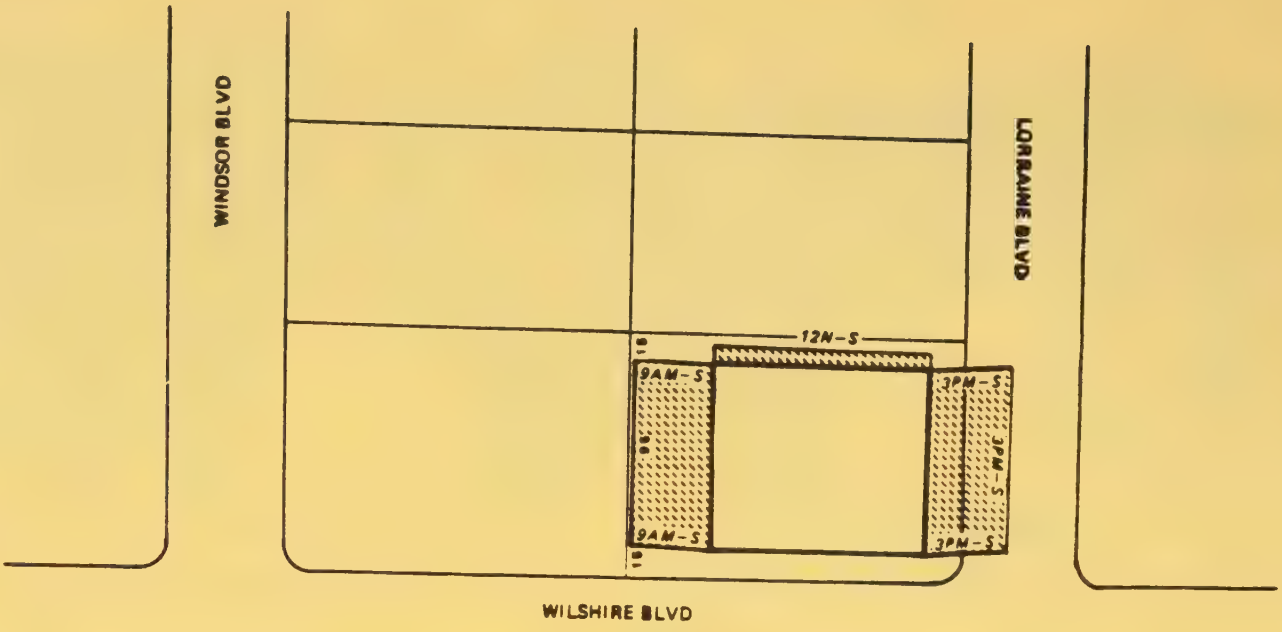


FIGURE 4-B: 3-STORY CONVENTIONAL

45-foot height limit, standard setbacks, no other controls.

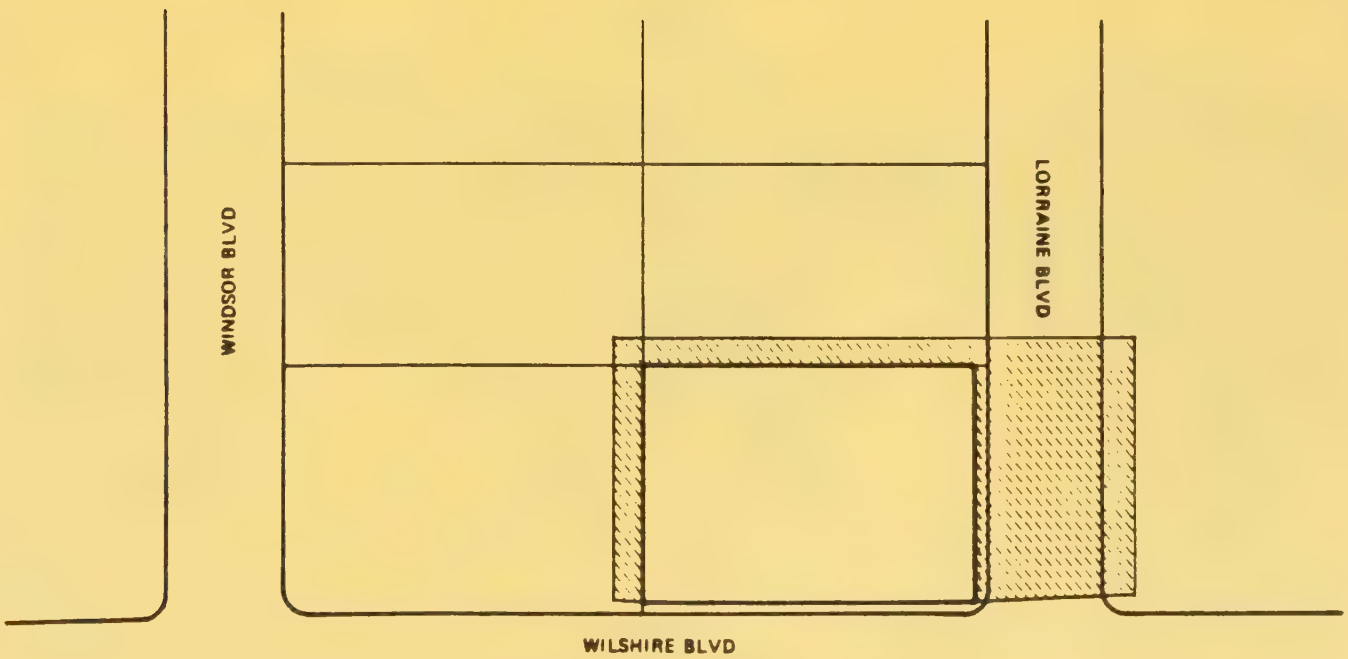


FIGURE 4-D: SOLAR ENVELOPE

May not shade beyond 8-foot fence at adjacent property lines, 9 a.m. to 3 p.m., all year.

FIGURE 5 (BOTH PAGES)

Winter Shadows, Sites 2 and 3

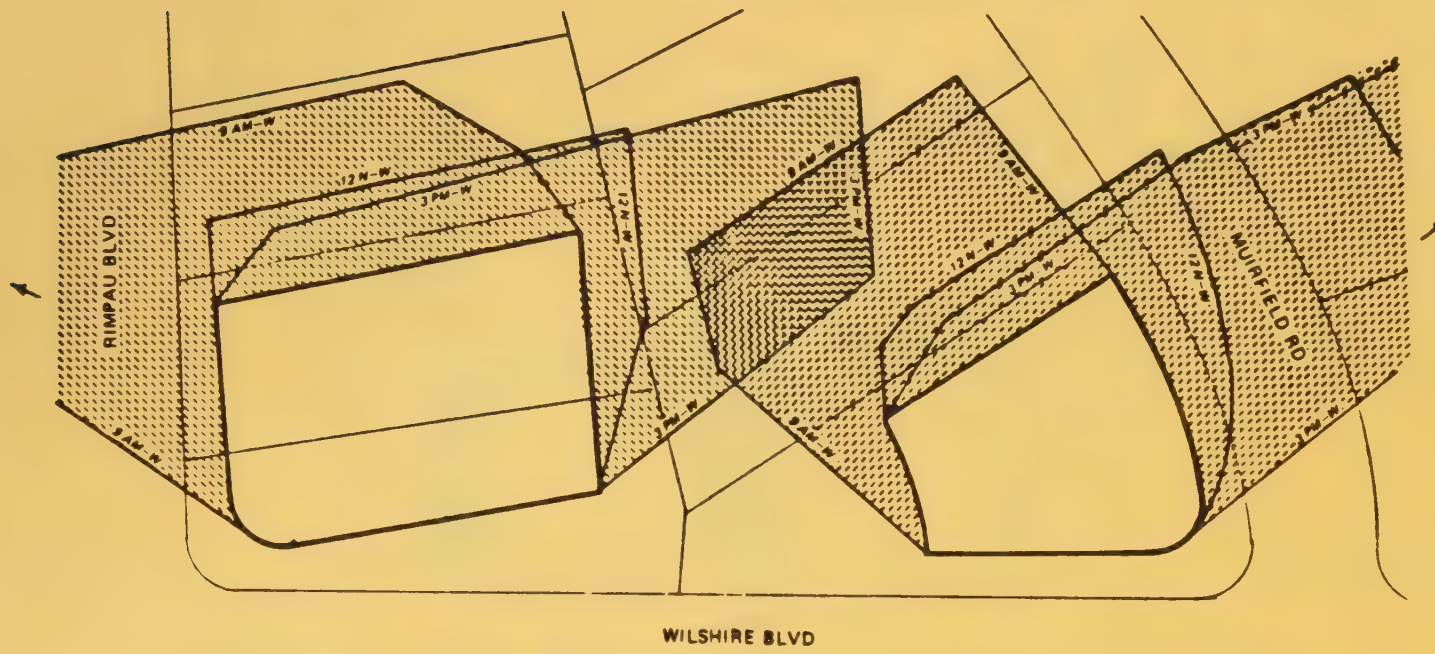
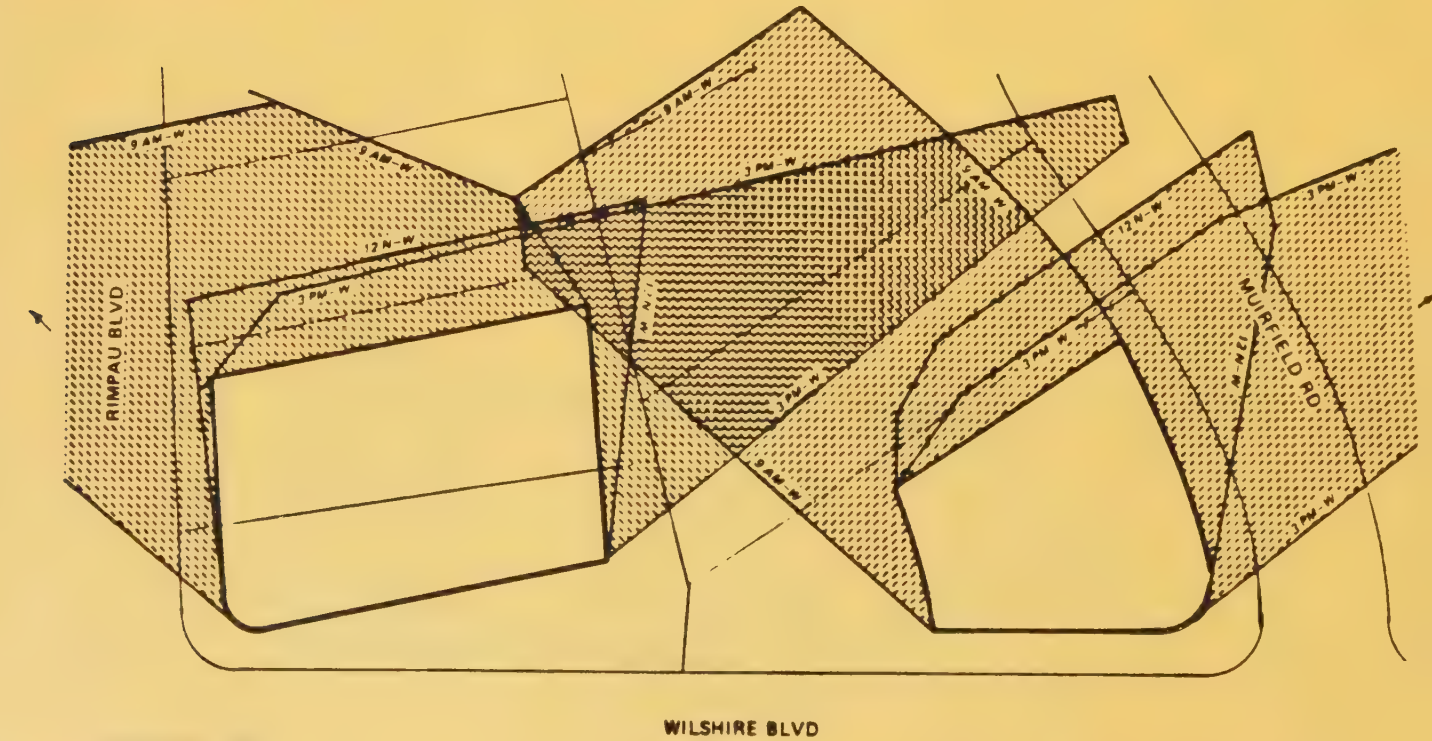


FIGURE 5-A: "TENT" WITH 45-FOOT HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.



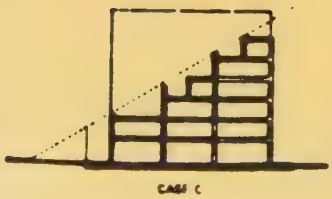


FIGURE 5-C: "TENT" WITH NO OTHER HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.

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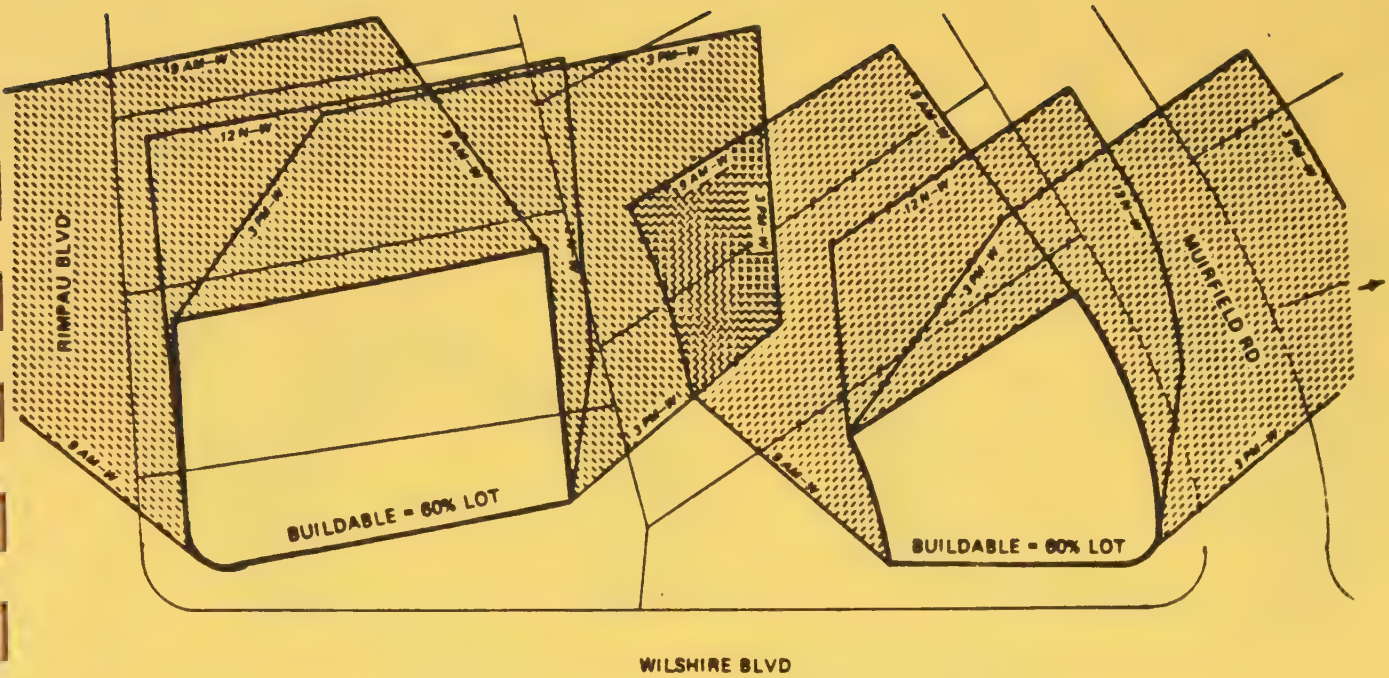
erence only; not to scale.



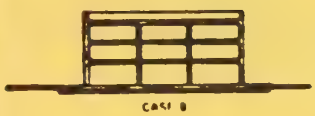


FIGURE 5-B: 3-STORY CONVENTIONAL

45-foot height limit, standard setbacks, no other controls.

FIGURE 5-D: SOLAR ENVELOPE

May not shade beyond 8-foot fence at adjacent property lines, 9 a.m. to 3 p.m., all year.

FIGURE 6 (BOTH PAGES)

Summer Shadows, Sites 2 and 3

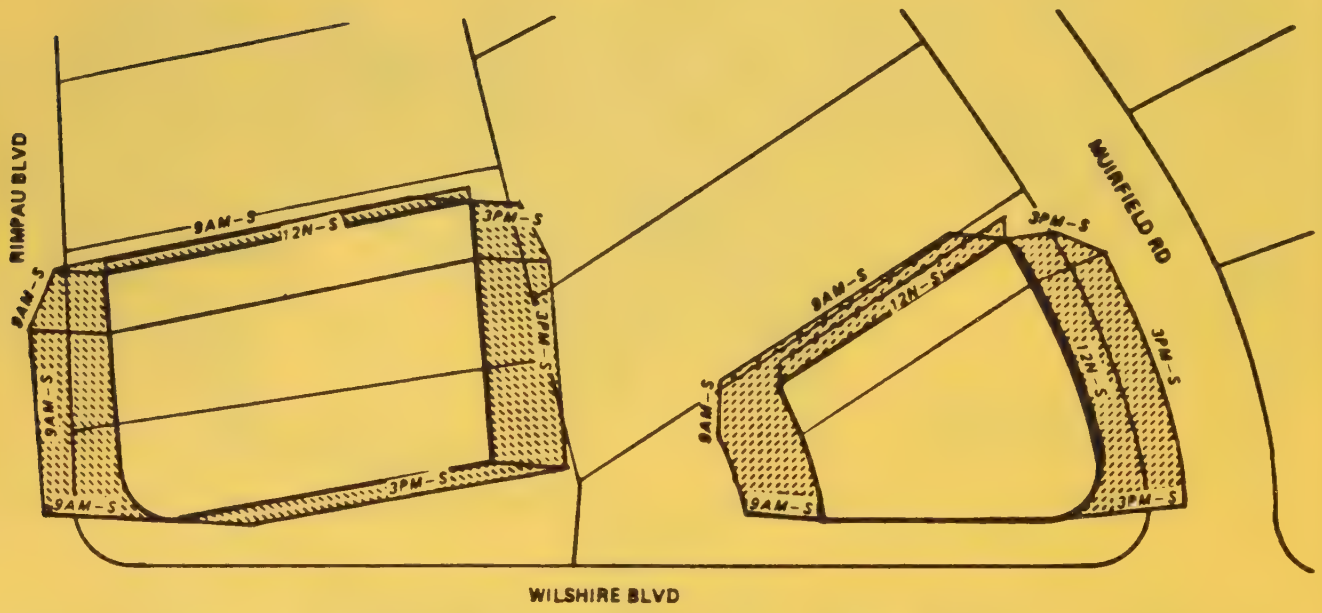
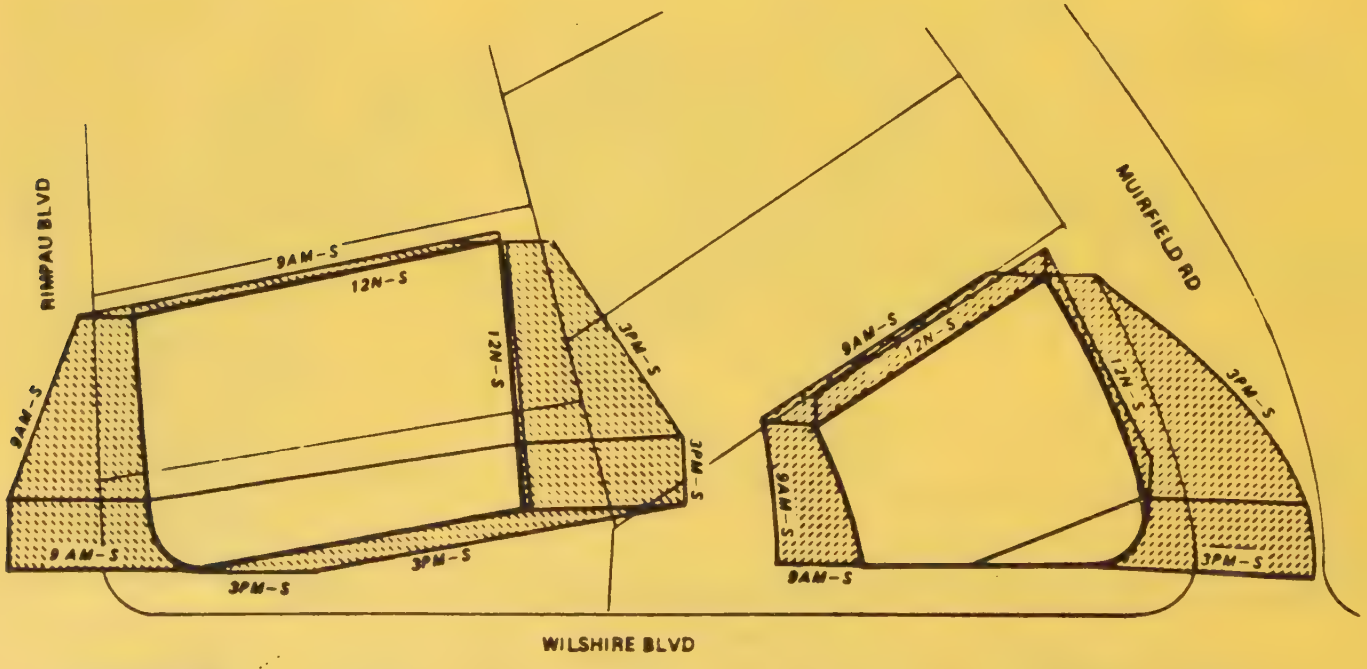


FIGURE 6-A: "TENT" WITH 45-FOOT HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.



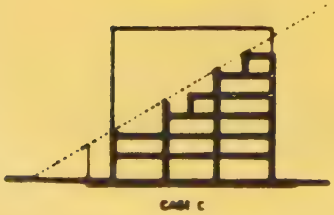


FIGURE 6-C: "TENT" WITH NO OTHER HEIGHT LIMIT
Tent defined by 30-degree slope from a point 20-feet above north property line.

all sections for conceptual
ference only; not to scale.

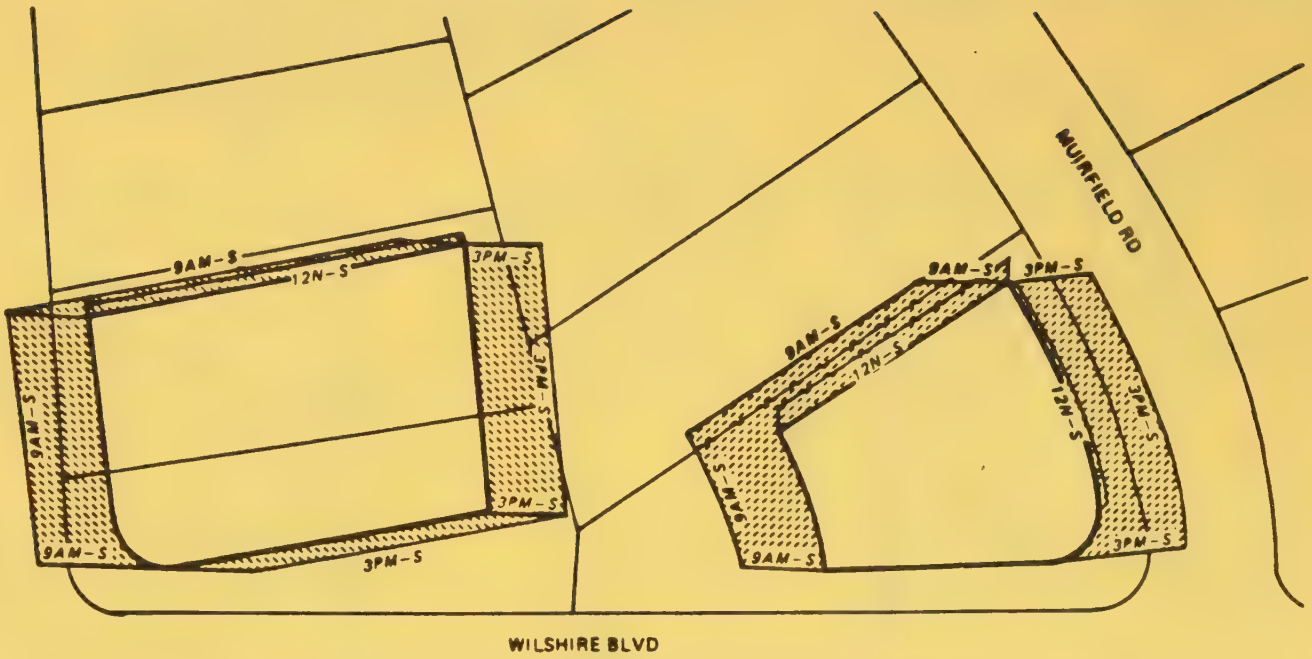


FIGURE 6-B: 3-STORY CONVENTIONAL

45-foot height limit, standard setbacks, no other controls.

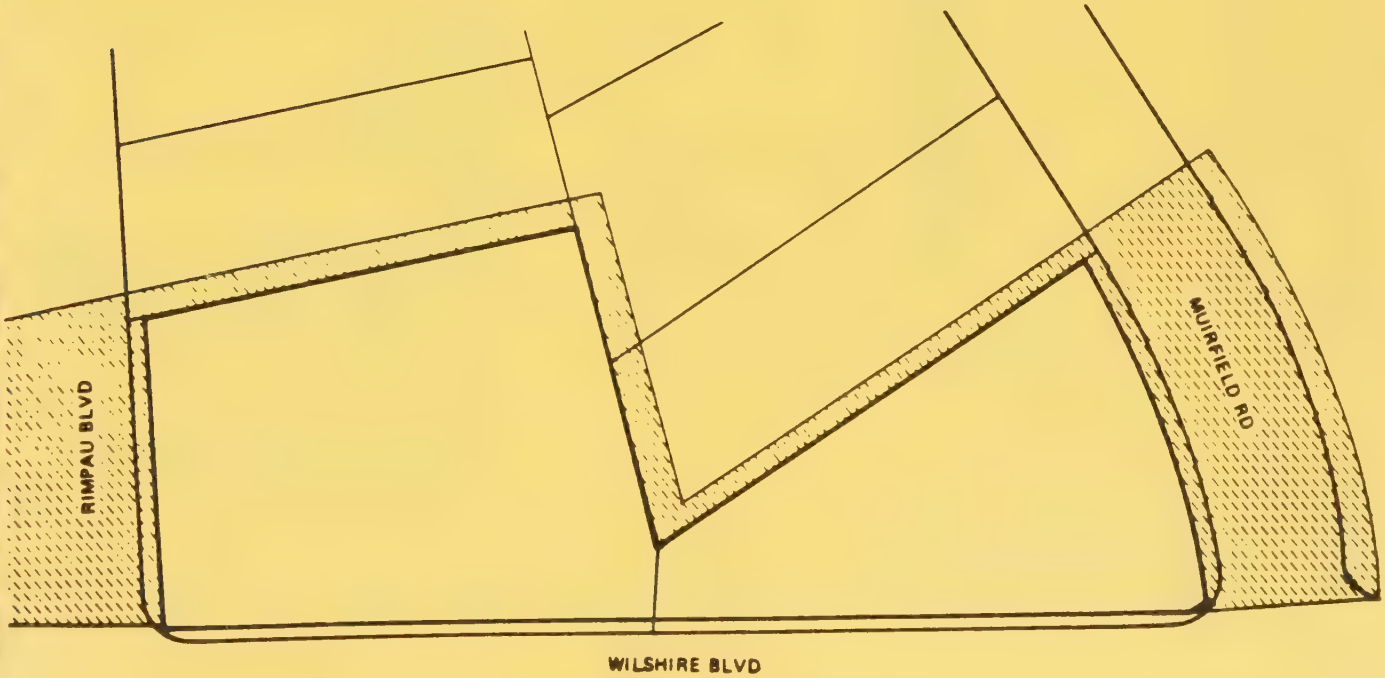
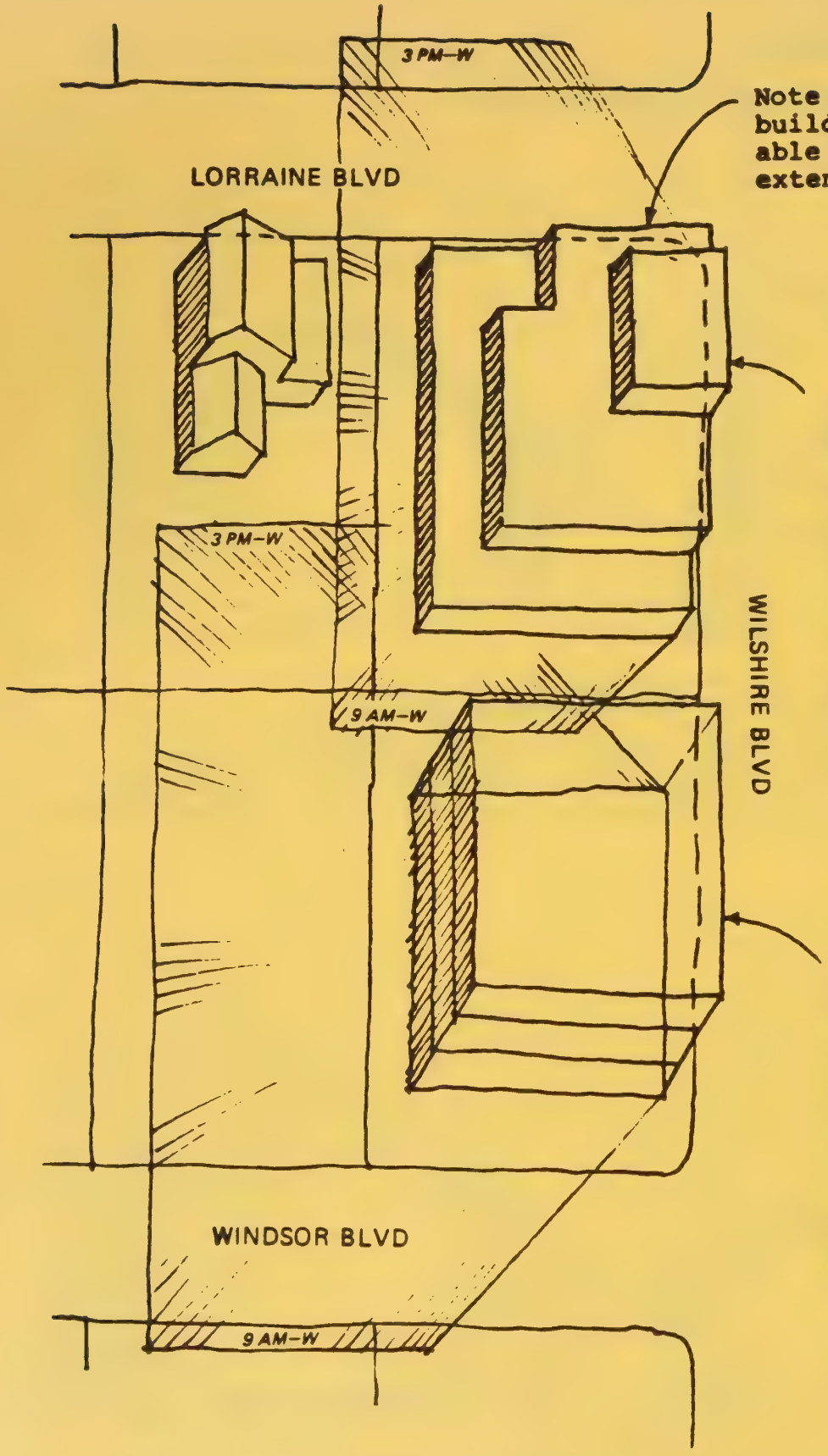


FIGURE 6-D: SOLAR ENVELOPE

May not shade beyond 8-foot fence at adjacent property lines, 9 a.m. to 3 p.m., all year.



Note additional building bulk available where shadows extend across street.

TYPICAL SOLAR ENVELOPE BUILDING

Worst-case shadows (Winter Solstice) do not extend into neighboring properties farther than shadows cast by 8-foot fence at the property lines, at any time between 9:00 a.m. and 3:00 p.m.

CONVENTIONAL 3-STORY BUILDING

Note that usable floor area is somewhat greater, but shadow impacts are increased considerably.

Even the deep set-backs do little to reduce shadow impacts.

FIGURE 7a COMPARISON OF SOLAR ENVELOPE BUILDING WITH CONVENTIONAL BUILDING

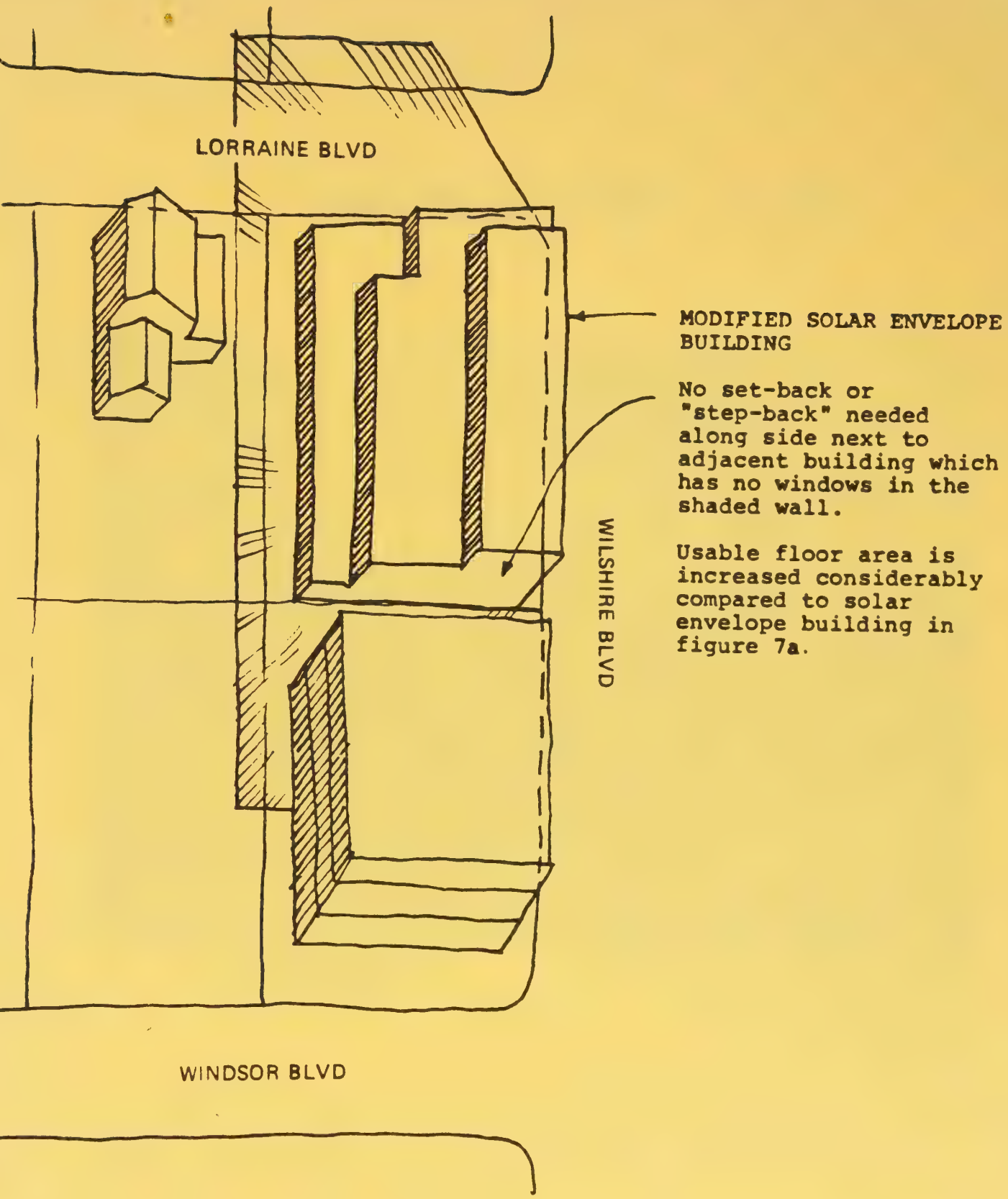


FIGURE 7b ILLUSTRATING THAT SOLAR ENVELOPE IS VARIABLE DEPENDING ON SURROUNDING DEVELOPMENT

Winter & Summer Shadows

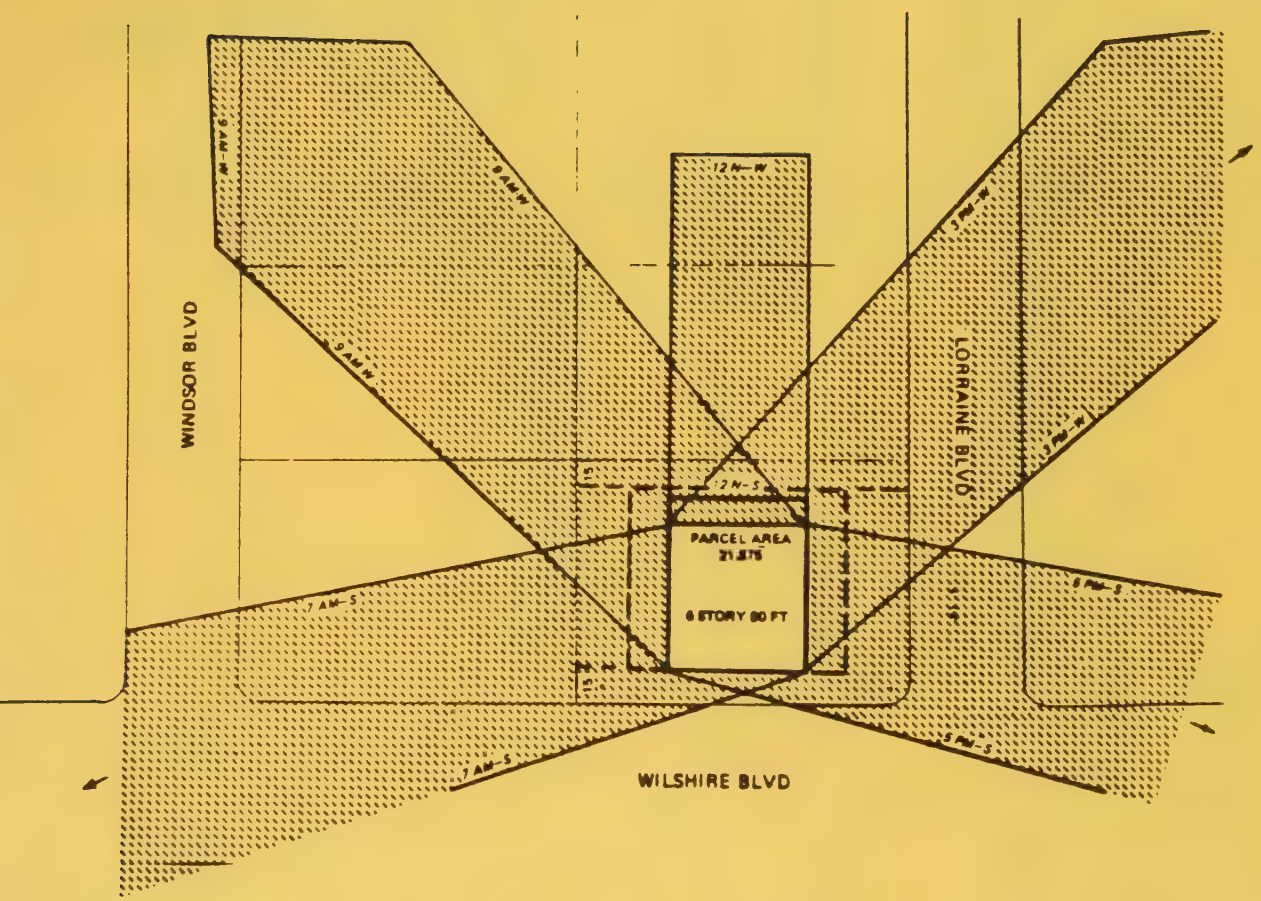


FIGURE 8

Plate 1. Irving north of Wilshire, looking southwest (toward Wilshire). A parking lot and foliage (Plate 2) screen the residential neighborhood from the shadows of a six-story structure.

Plate 2. A parking lot north of the commercial structure at Irving and Wilshire constitutes a buffer for the residential area.

Plate 3. Parking lot north of Wilshire, looking east from Hudson. Note dense foliage to the left, and 2:30 p.m. shadow (arrow) from six story structure.

Plate 4. Muirfield north of Wilshire. The first tier of residences to the north is completely hidden by dense shrubbery.

Plate 5. Wilshire and Muirfield, looking northwest. This parcel has approximately 180 feet of frontage on Muirfield, which would permit rear parking. Shadows from a three-story structure should not reach across established foliage.

Plate 6. Parking lot at Lucerne north of Wilshire, looking west. Shadow from church structure (approximately 60 feet) falls about one-third of the distance to the nearest residence.

Plate 7. Lorraine at Wilshire, looking west (See Plate 8 also). This parcel has 125 feet fronting Lorraine. The Park Mile Building Volume "Tent" could achieve only four stories here, if not limited to the 45-foot height.

Plate 8. Lorraine and Wilshire, looking northwest. The Park Mile "Tent" would preserve this sunny southern exposure, but at the expense of severely limited commercial floor space.

Plate 9. McCadden, north of Wilshire, looking west. Even though these residences are large, a certain incompatability with high rise structures appaars. Afternoon winter shadows will engulf this residence from Imperial Savings a block away.

Plate 10. North of Wilshire, west of Lucerne. This fine old residence enjoys a sunny southern facade, even though north of three or four-story commercial development.

Plate 11. Rossmore north of Wilshire, looking east. Work on this high-rise multiple residential structure was halted due to a disputed north building line (approximately 15 feet). If completed to six-stories, the two-story residence would be in extensive, almost continual shade.

Plate 12. Wilshire east of Plymouth. This single story structure has a roof that slopes down to the north, in keeping with the Park Mile "Tent". Set-back and landscaping demonstrate the Park Mile theme.

B. ENCINO SPECIFIC PLAN

This Specific Plan extends westerly from the San Diego Freeway to Lindley Avenue, while the north-south boundary is generally one short block north and south of Ventura Boulevard or the zone boundary between commercial and residential land uses.

The tier of lots facing Ventura Boulevard is completely developed mostly in commercial usage, but much less intensely than would be permitted by the District Plan (adopted March 10, 1976). Between the San Diego Freeway and Balboa there are approximately ten structures built to the maximum height limit of six stories for this area. The balance of the area contains numerous one-, two-, three-, four-story shopping centers, apartments, automobile agencies and small retail shops of various kinds, as well as restaurants. The auto agencies and restaurants have considerable surface area devoted to automobile storage and parking, so that only a small portion of the buildable area is occupied by structures.

On either side of Ventura Boulevard, a tier of R3 apartment developments generally separates the Boulevard activities from the established single-family residential areas to the north and the south. Homes in these areas are generally 10 to 20 years old and construction on "fill in" lots is currently underway. The result is a stable, luxurious neighborhood, with 1980 home values on the order of at least $150,000 north of the Boulevard and $200,000 and up on the south side.

The existing high-rise structures on the north side of Ventura Boulevard are generally provided with underground parking, so that practically the entire parcel is occupied with the structure. As a result, the entire lot of the northerly residential tier is blanketed by the winter noon-time shadows of the six-story structures. Since these are fully developed lots, the existing residential structures are currently deprived of practical solar access during a significant part of the day and year. Wall to wall high-rise would effectively blanket the first notherly tier of lots for the entire day and the entire year.

Future development, as controlled by the proposed Encino Specific Plan can avoid complete blanketing, primarily by limiting the buildable (commercial) area to one-half of the parcel area. Other potential controls, which would also relieve the monotony of continuous high-rise would require building profiles to slope down to the north, while permitting variable front and side building lines and a few narrow towers with a buildable area of 50 percent and an FAR of 3.

While there is no practical relief for present shadowing in the foreseeable future, solar energy could be provided for the shaded residential units by means of negotiated easements. This could permit the installation of solar energy collectors on the shading structure to benefit the shaded structure. Or it could take the form of one-time or continuing cash payments.

Many of the points made for the Park Mile Specific Plan would apply to the Encino Plan area. Other specific remarks are:

1. Property on the south side of Ventura Boulevard will probably become more valuable as it will support greater height under the envelope. The south side structures will have the advantage of casting shadows across the 100-ft. right-of-way. Those properties on the north side of the street would be prohibited from casting shadows

on the northerly adjoining residential properties. In addition under the University of Southern California proposal, the northerly properties have a further handicap in that solar access for residential property is guaranteed with relation to surrounding parcels rather than existing buildings. This situation may promote a transfer of development rights concept through purchase, land assemblage, negotiated easements, or other means.

2. Corner properties will become even more valuable because they will have the advantage of shading across rights-of-way in more than one direction.

3. Commercial properties will tend to develop parking on the north side of the property so that they can then cast shadows on their own parking. This works well on the north side of Ventura Boulevard where staff could envision a line of parking extending the length of the plan area to the rear of commercial structures similar to that shown on the plan map between Amestoy Avenue and Louise Street. The parking acts as a shadow buffer area between the commercial buildings and the northerly residential properties.

4. There are some height limits in the plan area of 1L (75 ft.) and 1-VL (45 ft.). A 75-ft. structure will cast a shadow approximately 262 ft. to the north on a December morning. Both distances are greater than the highway right-of-way of 100 ft. and would thus be reduced somewhat by the envelope, more so on the northerly properties.

Floor Area Ratios

Existing zoning in the Encino area allows a floor area ratio of three times the building area of a lot. The Encino-Tarzana District Plan would allow a range of floor area ratios from 1.0 to 3.0 The Specific Plan, however, divides the area into two portions: Area A from the San Diego Freeway to Balboa Boulevard and Area B from Balboa Boulevard to Lindley Avenue. For Area A, the Specific Plan recognizes the existing zoning and sets forth an FAR of 1.5. This would yield a gross floor area of 6,136,741 sq. ft. For Area B, the Specific Plan designates 2,094,697 sq. ft. of lot area for commercial activities. With an FAR of 1.5, Area B would have a potential GFA of 3,142,045 sq.ft. The total GFA of the Specific Plan area would be reduced to about 50% under that permitted by the zoning.

The USC envelope concept shows case studies of envelopes ranging from 3.0 to 6.28. Unfortunately, these reasonably high floor area ratios are generated by conditions that the staff considers should be changed in the envelope concept. To achieve the specified solar access, the zoning envelope reflects existing conditions surrounding the site and it is these variable conditions that improve building conditions on a site. The staff sees this relationship with existing structures as a form of "lot-by-lot" zoning and thus undesirable. The second reason for not wanting to address a relationship to existing structures in the zone is that it multiplies the work involved in creating any envelope. It could not be done in the office without a land use survey. It also makes population projections of larger areas impracticable. Without doing envelopes and land use surveys on many lots in the City, it would be difficult to plan densities for these community areas. The higher FAR's in the USC study were generated in what the staff considers special cases, i.e. adjoining a freeway; corner lots; assumed firewalls; partial coverages of a window wall; adjoining a vacant parcel; assumed vacant parcels where existing structures are less than 10% of allowed FAR; all parking assumed to be below grade, etc.

This analysis does not mean that it would not be possible to produce acceptable FAR's under the envelope concept, but that there will be additional costs and that those envelopes generated by USC need to be revised to consider parcels and not existing structures, etc.

Floor area ratios for City centers are much greater than those proposed by the USC Study. The Union Bank in Central City has a FAR of 4.4; Bonaventure Hotel has a FAR 9.7; Security Pacific Bank 8.7; Wells Fargo 11.4; Crocker (under development) 13.0 etc. These FAR's are usually generated in centers. Staff has assured the City's commitment to "centers" and therefore recommends a different approach to solar access in the centers such as duration of shadow.

Study Procedure

The purposes of this study is to compare the impact of the six-story, traditional style of building (Case A) with the possible impact of a building designed using solar envelope principles (Case B). A site was chosen along Ventura Boulevard between Gloria Avenue and Dunsmuir Avenue. The site in the middle of the block was chosen because it would represent a fairly restrictive set of conditions. Its size of about 260 ft. wide by 196 ft. deep is in the medium range for development properties along this section of Ventura Boulevard.

CASE A: SPECIFIC PLAN PROVISIONS

The Encino Specific Plan takes several steps to reduce the density of buildings along Ventura Boulevard. While this Plan was not finalized at the time of publication, its provisions are as follows:

1. Reduction of floor area ratio.

   In most cases the floor area ratio is reduced to 1.5:1 except in some cases where it is permitted to be 3:1 (see 2 below).

2. Reduction in buildable area.

   Buildings along Ventura Boulevard are not permitted to cover more than 50% of the area of the lot with one exception. If the development of the building retains 35% of the area of the lot as permanently maintained, landscaped open space, then the coverage of the building is permitted to include the remaining 65 percent of the area. Under these circumstances, the floor area ratio is increased from 1.5:1 to the 3:1 figure mentioned above.

3. Height Limitations.

   On approximately half of the area, i.e. Ventura Boulevard east of La Maida Street on the north side of Ventura Boulevard and east of Petit Avenue on the south side of Ventura Boulevard, the height limit is 75 ft. or six stories. In the remaining section of the Specific Plan area, the height limit is 45 ft. or three stories.

4. Buffering conditions.

   All new construction within the commercial zone where it abuts residential uses will provide a rear or side yard area bordered by a 6-ft.-high solid masonry wall measured from the finished grade on the rear property line.

From this wall extending 8 ft., plus one-sixth of the height of the building, but not to exceed 15 ft., will extend a landscaped rear setback area with plant materials of sufficient height and density to screen adjacent land uses.

5. Setbacks.
Five percent of the property will be devoted to a landscaped front setback area facing Ventura Boulevard.

What type of structure will these regulations allow in the designated area?

There will be two types of new construction, one following the 1.5:1 floor area ratio and the other following the 3:1 floor area ratio. The former type of building will be allowed to cover 50 percent of the property and therefore rise three stories above ground level in most cases. In those areas where six stories are allowed as a height limit, a 1.5:1 floor area ratio building could use several bottom floors for parking.

In the other case where the developer chooses to devote 35 percent of the ground level to public use as landscaped open space, the foot print of the building would be allowed to expand to 65 percent of the site. This would result in a building that could be six stories tall, covering 65 percent of the site and having a floor area ratio of 3:1. Calculations show that this would allow the developer to have approximately one-story at ground level devoted to parking with the remainder of the parking for the building underneath.

The Encino Plan also increases the requirements for building owners to provide off-street parking because of severe on-street parking problems in this area. Instead of the usual one space for every 500 sq. ft. of office space, the Plan calls for one space for every 300 sq. ft. of office space. This results in approximately the same number of square feet devoted to parking as to office space. These parking requirements would force a developer who is going to develop a floor area ratio of 3:1 to excavate the equivalent of five floors of parking under the site. The expense of this underground parking could be significant when compared to the expense of the overall development. It could even be an economic limiting factor for the overall development of the land in the area.

These buildings on the north side of Ventura Boulevard, if built in a high-rise configuration, would have a significant shading impact on the apartments and single-family homes to the north. Calculations show that if a building 75 ft. tall were built 15 ft. away from the rear property line, as allowed by the plan, at noon in midwinter the shadow would be cast some 100 ft. into the property adjacent to it. This would have a significant impact on a single-family home's rear yard or a devastating impact on a multi-family building occupying an entire site to the north of such a high-rise.

Figure 9-A shows an example of a six-story building with a total height of 60 ft., lot coverage of 65 percent and setbacks varying from 10 to 20 ft. Of the total floor area of 198,204 sq. ft., only 77 percent would be rentable, because of the FAR of 3:1. The remainder would be accessory and parking, with the additional required parking assumed to be subterranean.

CASE B: SOLAR ENVELOPE

The creation of criteria for the solar envelope is an interactive process in which the planner tries to balance development needs with solar access protection. Staff designed a preliminary envelope to study the potential of solar access zoning in the area. A list of guidelines arrived at which would ensure complete solar access for the residential units behind the commercial structures. These guidelines would also allow the type of commercial structure proposed for the area though not the type which exists in the area now. In this preliminary envelope, as in all envelopes, there is a tradeoff between the high degree of solar access provided to the residences (whole site access) and the solar access provided to other commercial structures, which is not nearly as generous.

The following criteria were used to establish the study envelope:

1. Residential property to the north would be guaranteed complete solar access except for the shadow cast by the 6-ft. privacy fence mentioned in the Encino Plan.

2. Instead of plotting existing structures, which would be too time consuming for a preliminary study, it was assumed that each lot was vacant and would be filled with a building of high density at some time. The bottom two floors would be allowed to extend all the way to the east and west property lines and become opaque fire walls. Beginning at the third floor, the east and west walls began to step back from the property line at an angle equal to the most restrictive solar angle. This ensures direct solar access to buildings on the east and west. This differentiation was made because the bottom two floors would likely be devoted to lobby areas, retail uses and parking which would not require solar access. This also approximates the "bottom one-third rule" on window wall shading in the USC report (p. 5-16).

3. All front yard, side yard and rear yard setbacks were eliminated, as were lot coverage and FAR limitations.

4. All other criteria used by Mr. Knowles, i.e. time of day and casting shadows across public spaces were included.

5. The requirement of one parking space for each 300 ft. of office space was used.

6. Height restrictions were removed.

While these restrictions allow less solar access to existing commercial structures along Ventura Boulevard than Mr. Knowles' restrictions, they offer improvements in solar access to the residential structures behind the commercial buildings, when compared to the standards promulgated by the Planning Department. Again, these restrictions represent a preliminary study, rather than a final access rule.

These rules, as a first draft, also represent a compromise between solar access (particularly critical for the residential structures) and densities for the commercial structures along Encino Boulevard.

The envelope as designed, steps up from the 6-ft. fence at the north property line at an angle equal to the winter altitude of the sun at noon. On the east and west sides of the site the envelope steps away from a point two stories above ground level at an angle determined by the altitude of the sun in the winter at 9 a.m. and 3 p.m. If developed to

its maximum potential the envelope would reach a height of approximately 90 ft. above ground level. This height is limited by the angle of the sun in the morning and afternoon during the winter and the resulting slopes facing east and west. (See Figure 9-B).

As in the Wilshire Park Mile area the uppermost floor would be very small and thus would probably be eliminated by a developer unless unusually high rents could be charged for such a small penthouse arrangement. This would reduce the overall height.

Because Ventura Boulevard lies to the south the facade can go up to the edge of the site. It will only cast a shadow onto Ventura Boulevard in the late afternoon and early morning times during the summer. This high facade facing Ventura Boulevard represents a significant departure of physical design from what is proposed in the existing ordinance.

The total developable area of the envelope would be 198.416 sq. ft.

When this number is divided by the area of the property, 51,540 sq. ft., the result is a floor area ratio of approximately 3.8:1. However, just because the envelope allows a FAR of 3.8:1 does not mean that it is feasible to design a building that can take full advantage of this volume. If an average is taken of all of the ratios of the designed FAR of the USC student's building verses FAR of the envelope as listed in Table 1 p. 94, in the USC report, we come up with an average multiplier of .79. This average, while not decisive, gives some indication of how much area will be lost in the design process through court yards, light wells and other features which will reduce density but increase the amenities of the building. (The USC students were very concerned about this issue in most cases). This density and ratio represents a conservative number. Experienced architects could probably gain more density out of a given envelope. When this number, .79, is multiplied by the floor area ratio 3.8 the result is roughly a FAR of 3.

CASE C: "TENT" CRITERIA

Figure 9-C illustrates a compromise type of solar envelope, the same "tent' at that which has been defined in the Park Mile Specific Plan. The tent is defined as follows:

1. The height is limited by a plane which slopes upward at an angle of 30 degrees from the top of an imaginary 20-ft.-high wall along the north property line.

2. There are no other height limits and in this example, no setback requirements or limitations on FAR (Floor Area Ratio: a measure of density.)

The shading effects of the tent are less than the standard six-story building in Case A, but greater than the full solar envelope in Case B.

Compared to the full envelope in Case B, the "tent" protects adjacent residential to the north nearly as well (except that the wall or fence along the north property line is 20 ft. high, instead of 6 ft. high). However it does not do nearly so well in protecting solar access to adjacent commercial structures.

Nevertheless, the tent might be an acceptable compromise between the standard medium-rise or high-rise development (typified in Case A) and the full-scale solar envelope such as described by Mr. Knowles (illustrated in Case B.) This is because:

1. It is far easier to compute, since it is a shape dependent only on the dimensions of the subject lot and is independent of surrounding conditions or compass orientation.

2. It protects the adjacent residential properties almost as well and could be further improved, if desired, by lowering the 20-ft. starting height to 6 ft. or 8 ft.

3. It provides considerably more usable floor area (in our example 338,260 sq. ft. as compared to 198,416 sq. ft.)

It is acknowledged, however, that the "tent" criteria would probably result in less interesting development than would the full solar envelope and that it is less effective in ensuring solar access to the commercial properties adjacent to either side.

SUMMARY

1. A developer working on an envelope or on a "tent" restricted site in the Encino area can achieve an FAR equal to or greater than more restrictive rules proposed in the Specific Plan.

2. The development, as defined by the envelope and to a lesser extent by the "tent", insures solar access to the residential areas, casting shadows a minimum of 100 ft. into the adjacent properties on the worst day of the year.

3. The development, as proposed by the solar envelope, allows solar access to the upper floors of a structure to the east and west of the development. Under the existing plan, a series of high rises would block each other from the sun's rays during periods throughout the day, as would buildings developed under the "tent" provisions.

4. The existing plan would create a zone along Ventura Boulevard of landscap setbacks and towers. These towers would be surrounded by landscaped open spac The front setbacks would average some 10 ft. from the street (5% of the aver 200-ft. depth of property). The envelope and "tent" plans on the other hand wc create a solid wall at ground level at the property line along Ventura Boulevard. the north side of the street this wall as we have seen would be some 90 ft. in hei at its top. In the full envelope alternative, at about 24 ft. above street leve would begin to step back away from adjoining buildings to the east and west.

5. The buildings created by the "tent" or solar envelope would be more expensiv o design and build than the building created by the traditional planning scheme. is is because they would have a greater surface area, and a greater numbe of irregularities, not commonly found in the traditional square office building.

In an area as large as the Encino Plan there are many variables among the sites, so these findings would not apply to each one. The geometry of solar access, though, is consistent over the whole area. This creates certain similarities between sites and a basis for comparison. The following statements are based on these similarities and would apply to the entire Encino area:

1. Sites on the south side of the street could be developed to a greater density than similarly sized sites on the north side of the street. Those on the south side can cast a shadow entirely across Ventura Boulevard, while those on the north side must terminate their shadows at the imaginary walls on the northern property line.

2. As Mr. Knowles' work has shown, buildings on smaller properties cannot be developed to as high a density as those on larger properties.

3. In the envelope study done for this report, no examination was made of existing buildings along Encino Boulevard. The densities that were arrived at are a result of an envelope which would guarantee solar access only to other envelopes of an equal size. This approach is contrary to Mr. Knowles' approach in the downtown commercial area. Mr. Knowles' study examined what a particular lot could hold in terms of FAR when considered in relation to the existing structures surrounding it. This preliminary study reflects the types of density possible in an overall area, independent of surrounding structures. If this type of envelope were put into effect small buildings would have their solar access blocked by these "envelope" buildings, while large towers would block solar access to the "envelope buildings". This is not to imply that this should be the case, it was only done to arrive at preliminary estimates of overall density ranges.

4. The physical character of Encino Boulevard would change a great deal. If buildings were to take maximum advantage of the envelope, they would come up to the front property line and go straight up for 60-90 ft. There would be few openings between buildings at ground level, creating a visual "canyon" effect along the Boulevard.

5. Except for some small sites lying on the north side of Ventura Boulevard, densities under this preliminary "envelope" will be able to meet the 3:1 FAR mentioned in the original plan. On some small sites, this 3:1 floor area ratio may be met if solar access to sites on the east and west of the development site can be sacrificed, as is done under the "tent" alternative.

Changing the regulations for establishing the envelope (ignoring existing buildings, assuming fire walls at the bottom two floor levels, opening the possibility of eliminating access to buildings on the east and west altogether) may cause some concern, but there is nothing fixed about the regulations established by USC. They were generated for the particular set of sites and conditions chosen by the University of Southern California. Other rules and variations can and should be analyzed for their applicability in various areas. The City Attorney has made it clear that regulations can be varied to reflect local conditions as long as they are applied with consistency over a geographic area of some reasonable minimum size.

CONCLUSIONS TO THE ENCINO AREA

The Encino Specific Plan represents a unique set of conditions for a commercial site. The relative low-rise character of the existing strip is in contrast to the higher density of the new structures, the mix creating an area under a great deal of controversy. Local land owners that live in the areas immediately to the north and south of Ventura Boulevard find themselves on the opposite side of the development fence from those people who own frontage directly along Ventura Boulevard. These forces have combined to create a plan which restricts high-rise development along Ventura Boulevard and encourages the development of large areas of landscaped open space. The three urban design results of this plan are:

1. Allowing higher density (3:1 FAR) development under some circumstances, as long as it is keyed to landscaped open space.

2. Encouraging off-street parking and in some circumstances underground parking.

3. Allowing some solar access by minimizing shading of houses to the north of commercial structures along Ventura Boulevard.

The central issues here are a microcosm of the issues surrounding the "centers" controversy mentioned before. There is an essential conflict between the high-rise physical configuration, as encouraged by the traditional planning theory and solar access. The "centers" concept is a planning concept of which one component is physical appearance.

The most difficult planning problem may be to understand what this new physical environment will look like: its aesthetic impact on the City. The point is not simply to compare the relative access merits of one plan versus another. The plans should be compared in their entirety. The solar envelope is a break with the status quo and implies a different physical structure for the City.

The City must be open to new ideas on how to achieve various goals through new physical prototypes. The solar envelope is just one of many that are available. Ventura Boulevard would have an entirely different visual appearance if the solar envelope were used. What must be decided is whether this area is better served by the buildings which create this new physical appearance or by buildings which more closely resemble the status quo.

A tabular summary of the three cases is presented on the following page.

TABULAR SUMMARY OF THE THREE CASES CONSIDERED IN THE ENCINO AREA STUDY

Building Type	Specific Plan (Standard six-story bldg.)	Knowles USC "Solar Envelope"	"Tent" type solar envelope
Case & figure	Case A Figure 9-A	Case B Figure 9-B	Case C Figure 9-C
No. stories	Six stories	Eight stories	Eleven stories
Height	60-72 ft.	80 ft.	110 ft.
Maximum potential floor area above ground	198,204 sq. ft.	198,416 sq. ft.	338,260 sq. ft.
Solar access to adjacent residences	Some protection (height limit)	Complete protection (6-ft. wall)	Very good protection (20-ft. wall)
Solar access to adjacent commercial	Some protection (side yards)	Excellent protection	Little or no protection
Calculation of envelope	Simple calculation	Very difficult calculation	Relatively easy calculation
Design and construction costs	Costs minimized	Costs increased drastically	Costs increased significantly
Lot coverage	65%	95%	100%
Ground level open space	Some	Almost none	None
Potential for terraced gardens	No	Yes	Yes

5268C/0180A

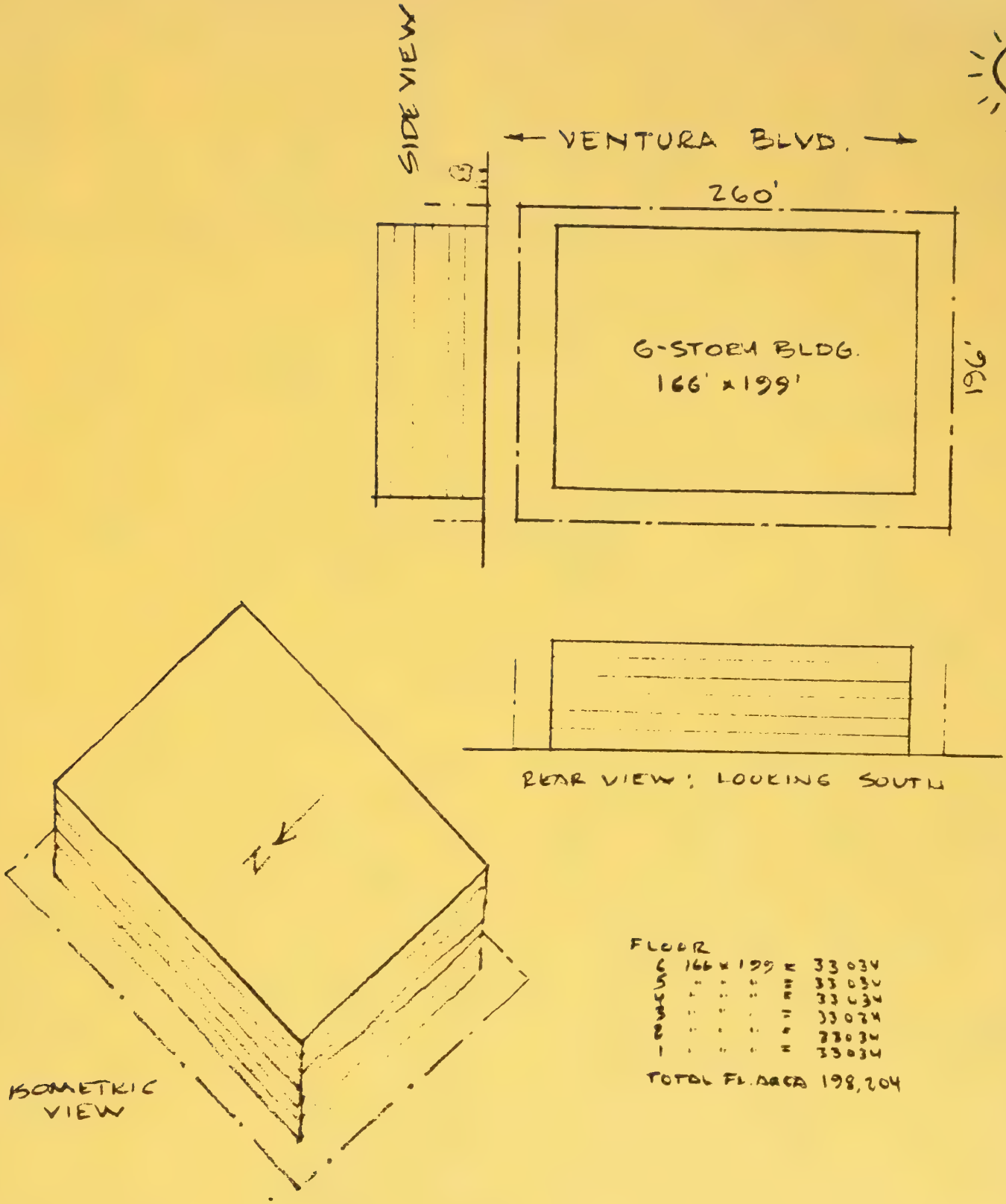
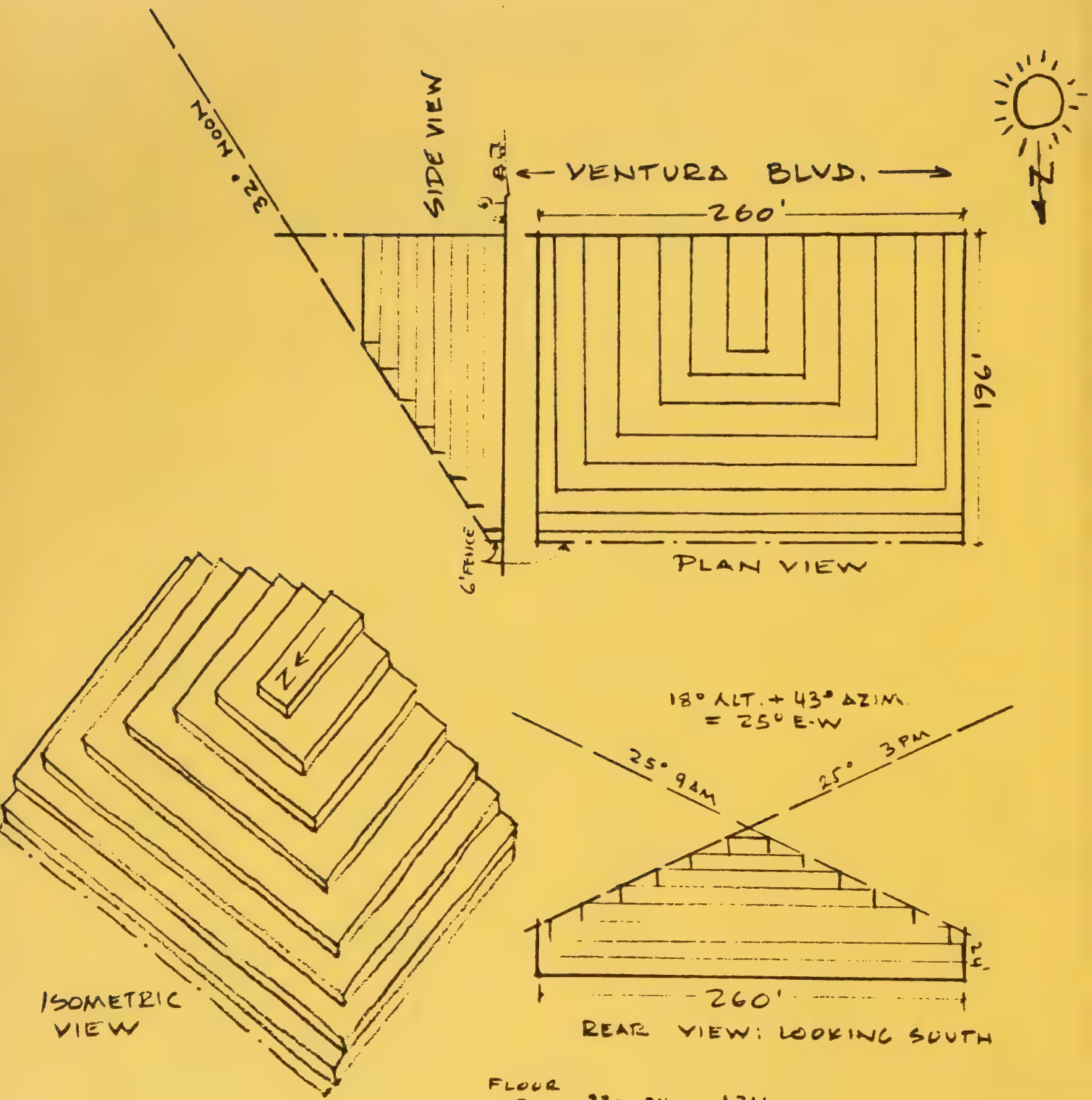


FIGURE 9A

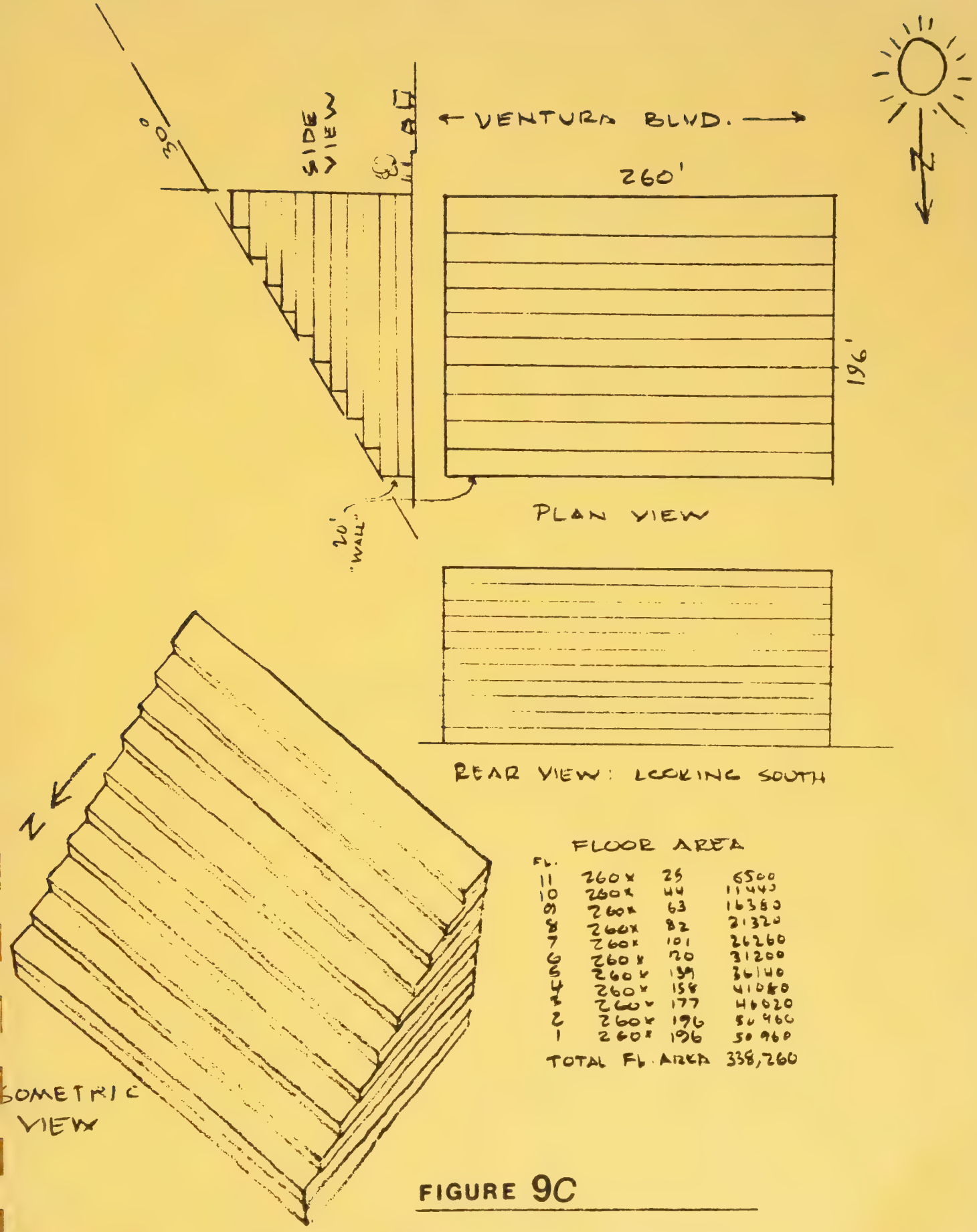
CASE A: ENCINO PROPOSED SPECIFIC PLAN



FLOOR			
8	22 ×	78	1716
7	66 ×	94	6204
6	110 ×	110	12100
5	154 ×	126	19404
4	198 ×	142	28116
3	242 ×	158	38236
2	260 ×	174	45240
1	260 ×	190	49400
TOTAL FL. AREA			199,416

FIGURE 9B

CASE B: SOLAR ENVELOPE



FLOOR AREA

FL.			
11	260 x	25	6500
10	260 x	44	11440
9	260 x	63	16380
8	260 x	82	21320
7	260 x	101	26260
6	260 x	120	31200
5	260 x	139	36140
4	260 x	158	41080
3	260 x	177	46020
2	260 x	196	50960
1	260 x	196	50960
TOTAL FL. AREA			338,260

FIGURE 9C

CASE C: "TENT"

VII. LEGAL IMPLICATIONS OF THE SOLAR ENVELOPE

(PREPARED BY THE CITY ATTORNEY'S OFFICE)

LEGAL ASPECTS OF PROTECTING SOLAR ACCESS BY USE OF SOLAR ENVELOPES

INTRODUCTION

Providing adequate protection for solar access is one of the institutional and legal hurdles which must be overcome to facilitate a widespread use of solar energy. Use of solar envelopes to protect solar access is a provocative concept, but one that necessarily raises a number of legal questions. A determination of the desirability of use of envelopes as opposed to other methods of protecting solar access entails an evaluation of the administrative and legal burdens which might be created by adoption of solar envelopes, and a candid assessment of the inher nt merits of the envelope. This section of the report deals with the legal aspects of utilizing solar envelopes.

In preliminary discussions regarding possible implementation in Los Angeles, the following questions were selected for legal analysis:

1. Does the City have legal authority to impose such envelopes?

2. What is the potential liability under State and Federal law for the resultant restrictions on property?

3. If envelopes are applied to a limited number of parcels, or result in different restrictions on similar types of property because of the height or location of adjacent buildings, topography, or for other reasons, is there an unconstitutional denial of equal protection of the laws?

4. What are the legal implications of various methods of implementation?

5. What relationship would the use of envelopes have to the City's obligations under the California Solar Rights Act?

Although many of the questions are not free from doubt, we conclude:

1. As a Charter City, Los Angeles clearly has authority to utilize solar envelopes to protect solar access.

2. Restrictions on property are valid under existing California law as long as they reasonably relate to a legitimate public purpose and do not deprive the property of substantially all economic use. If the regulation does constitute a "taking" the remedy is normally mandamus or declaratory relief to set aside the regulation rather than an action for inverse condemnation. Pending state legislation and a U.S. Supreme Court case could, however, affect this conclusion. Under the federal Civil Rights Act there is a potential for damages, if the regulations are found to constitute a taking, but a number of governmental immunities and defenses could be raised.

3. As long as there is a rational basis for the classification, limiting application to certain types of properties or imposing envelopes using standard criteria which nonetheless result in different property restrictions does not deny equal protection.

4. Envelopes could be imposed through amendment to the General Plan, Citywide Zoning Ordinance, community or specific plans, and to Community Redevelopment areas. Application by Council districts or on parcels of limited size and ownership are not recommended. Variances from the envelope requirement can be utilized to relieve hardships, but widely applied exceptions from existing requirements should not be achieved by use of variances.

5. While the use of solar envelopes is compatible with the California Solar Rights Act, they would not fulfill the City's duties under the Act.

The following analysis sets forth the reasons for these conclusions.

I. The City can use its zoning power to impose solar envelopes for purposes of protecting solar access.

In an article entitled "A Proposed Solar Zoning Ordinance" (Urban Law Annual, Vol. 14:211, 1978) three attorneys studying solar access conclude it is questionable whether the purposes for which zoning restrictions may be imposed under the Standard State Zoning Enabling Act adopted by most states are broad enough to include solar zoning. This concern is probably most legitimate in regard to the authority to control vegetative growth. They therefore recommend that state enabling legislation be amended to insure that municipalities can zone for solar access. Urban Law Annual, at 218. There are several reasons, however, why we conclude that it is extremely unlikely that a City solar envelope ordinance would be set aside as outside the City's authority.

First, and most importantly, the City of Los Angeles is a charter city with the right to pass and enforce any police laws not in conflict with the statutes of the State. L.A. Charter Article I, Section 2(b).

Under the Charter the City has broad powers, which in light of current energy needs would probably be construed to include the power to impose solar envelopes as a method of protecting solar access. Amongst those powers specifically provided the City by the Charter are those:

> "To enforce and promote the public peace, health, safety and welfare." Section 2(11)(a); and to "district or zone the city in whole or in part for purposes of municipal legislation applicable to any such districts or zones." Section 2(11)(o).

In determining whether this broad Charter language is sufficient to sustain solar access zoning, a court would consider that before a zoning ordinance can be held unconstitutional in federal courts "it must be said ... that (its) provisions are clearly arbitrary and unreasonable, having no substantial relation to the public health, safety, or general welfare." Village of Euclid Amber Realty Co., 272 U.S. 365 at 395 (1926). California law is to the same effect. "In deciding whether a challenged ordinance reasonably relates to the public welfare, the courts recognized that such ordinances are presumed to be constitutional and come before the court with every intendment in their favor." Associated Home Builders v. City of Livermore, 18 Cal.3d 582 at 605 (1976).

Second, if the Charter does not specifically provide for powers from which solar access zoning powers could be derived, the City would not be limited from enacting such zoning. "Subject to constitutional limitations, the City operating under a charter may exercise powers not expressly provided for in the Charter." Wiley v. City of Berkeley 136 Cal.App.2d 10 at 13 (1955).

Finally, a court determining whether the exercise of the zoning powers for solar access was for the purpose of furthering the general welfare would consider the State's declaration of policy in 1978 Solar Rights Act. The Legislature declares:

> "The use of solar energy systems will reduce the state's dependence on nonrenewable fossil fuels, supplement existing energy sources, and decrease the air and water pollution which results from the use of conventional energy sources. It is, therefore, the policy of the state to encourage the use of solar energy systems. In order to insure uniform application of this policy in all parts of California, the provisions of this act shall be applicable to charter cities. The purpose of this act is to promote and encourage the widespread use of solar energy systems." Chapter 1154, 1978 Legislative Session, Section 2(b)(c).

For all the above reasons, there is no significant question regarding the City's authority to impose solar envelopes.

II. Restrictions on development resulting from imposition of a solar envelope may be sustained as long as substantially all reasonable uses of the property are not taken. If a "taking" does occur, it is unlikely that the City or its officers or employees will be liable for damages.

While the City clearly has legal authority to impose solar envelopes to protect the public welfare, land use restrictions are often challenged by property owners who claim the restrictions constitute a "taking" requiring just compensation under the California and U.S. Constitutions. (See Cal. Const., Art. I, 19 U.S. Const. Amend 5;)

The following analysis discusses California and federal inverse condemnation law, and the possibility of damages being imposed for violation of a property's owner's rights. We conclude that: 1) as long as a solar envelope does not deprive landowners of substantially all reasonable uses of their property restrictions will be sustained under both federal and state law; 2) damages for solar restrictions will not likely be awarded under existing California law, although pending legislation or Supreme Court reversal of a recent California Supreme Court decision could change this situation; and 3) under the federal Civil Rights Act: a) if authority to establish envelopes is created by ordinance, the individual Council members could raise the defense that they acted in good faith; b) the City can no longer rely upon the qualified immunity provided by a good faith defense to a Section 1983 action.

A. Challenging Solar Envelope Under Existing California Law

Under California law, a land use restriction will be held unconstitutional only when its effect is to deprive a landowner of substantially all reasonable use of his or her property. A mere dimunition in value does not result in unconstitutional action. When all reasonable use is denied, the remedy for such action is mandamus to set aside the regulation, not an inverse condemnation action for damages.

In 1975, the California Supreme Court decided that a land owner could not obtain compensation for the mere diminution in value to land caused by a zoning change. The court held that a zoning ordinance which only decreases the market value of property does not violate the constitutional provision forbidding uncompensated taking or damaging of property. HFH Ltd. Superior Court. 15 Cal.3d 508 (1975). HFH involved a zoning amendment that reduced the value of the land by more than 80 percent, from $400,000 to $75,000. The HFH opinion noted that the decision did not determine whether a landowner is entitled to compensation if a zoning regulation removes virtually all the property's value.

The California Supreme Court recently answered this question in Agins v. Tiburon, 24 Cal.3d 266 (1979). On January 7, 1980, the U.S. Supreme Court agreed to review the California decision. Agins held that a landowner was not entitled to recover compensation when a zoning regulation destroys all value to the land for any purpose or use. The court held that when a public agency has adopted a zoning ordinance or any other regulation which deprives the landowner of substantially all reasonable use of property, the landowner's recourse is to invalidate the regulation, by challenging the constitutionality of such action, or the manner in which it is applied to his or her property, through an action for declaratory relief or administrative mandamus. The property owner may not, however, recover money damages on the theory that his or her property has been inversely condemned or "taken" by the government for public use, by the adoption of a land use regulation.

The Agins decision affirms the relatively wide latitude enjoyed by local government to regulate land uses without fear that, under California law at least, they will have to compensate a property owner for the loss sustained. Any U.S. Supreme Court decision on this issue could have important consequences for the likelihood of imposition of solar envelopes being treated as a taking, and additional review of the question should be undertaken after the Supreme Court's decision.

B. AB 3017 - Substantial Impairment Compensation Legislation

In response to the California Court's decision in Agins, substantial impairment legislation has been introduced in the California Legislature. AB 3017 (Naylor) and SB 1869 (Maddy) both provide a caused action for equitable and monetary damages to a property owner when the action of a public entity substantially impairs or reduces the value of the property. The two bills are essentially the same. AB 3017 is attached for reference.

Enactment of this legislation could substantially lessen the willingness of local government to adopt innovative land use regulations, and would increase the likelihood that application of solar envelopes to some parcels of property would result in a requirement for compensation. AB 3017 and 1869 should be carefully monitored for its potential impact on the viability of solar land use controls.

C. Federal Actions Challenging Imposition of Solar Envelope Restrictions

As a result of the limitation on inverse condemnation actions imposed by California courts, plaintiffs are increasingly likely to bring their actions in federal court under the Fifth and Fourteenth Amendments just compensation provisions of the Federal Constitution, as well as Section 1983 of the Federal Civil Rights Act for money damages to remedy alleged deprivations of constitutional guarantees.

Regulation of property may constitute a taking requiring just compensation under the U.S. Constitution, but the fact that there is a severe dimunition in property value is not determinative. The reasonableness of the regulation will be considered. Prudence, however, dictates an analysis of the likelihood that a property owner could successfully argue that restrictions imposed by way of solar envelopes effectively "took" his or her property.

The Fourteenth Amendment prohibits any state from depriving any person of property without due process of law and further prohibits any state from denying any person equal protection of the laws. The Fifth Amendment, which also contains a due process clause, prohibits the taking of private property for public use without just compensation. The just compensation clause has been made applicable to actions by states under the Fourteenth Amendment in a long line of cases beginning with Chicago B. & O. Railroad Chicago, 166 U.S. 226 (1897).

Recently in Pennsylvania Central Transportation Company City of New York, 438 U.S. 104, 57 ed2d 631 (1978), the Supreme Court summarized the rules relating to federal taking law as applied to local government.

First, the court acknowledged that it "has been unable to develop any 'set formula' for determining when 'justice and fairness' require that economic injuries caused by public action be compensated by the government, rather than remain disproportionately concentrated on a few persons." The validity of the government's action depends largely upon the particular facts in the case. Penn Central at 648. Second, physical control of the property by the government is not required, but "a 'taking' may more readily be found when the interference with property can be characterized as a physical invasion by the government ... than when interference arises from some public program adjusting the benefits and burdens of economic life to promote the common good." Penn Central at 648. Third, the economic impact of the regulation on the complainant, and the extent to which the regulation interferes with reasonable investment supported expectation are relevant considerations. Penn Central at 648. Fourth, a court will look at allowable uses for the entire property, rather than specific segments to determine whether rights in any one segment have been entirely abrogated. Penn Central at 652. Fifth, a use restriction on real property must be reasonably necessary to the effectuation of a substantial public purpose, and the judicial inquiry when a property owner challenges a zoning ordinance is whether the restrictions can reasonably be deemed to promote community purposes, and will include consideration of the treatment of similar parcels. Penn Central at 650 and 654.

The Court in Penn Central summarized cases where regulations were sustained despite very substantial reductions in value; e.g., 75% and 87-½% diminution in value. Penn Central at 653. It also discussed those cases where regulations have been held to constitute a taking. In one of those cases (Hudson Water Co. v. McCarter, 209 U.S. 349, 355, 52 L.Ed. 878 (1908)), the Court stated if a height restriction "made property wholly useless, the rights of property ... prevails over the public interest, and compensation is required." In another case (Pennsylvania Coal Co. v. Mahon, 260 U.S. 393, 67 L.Ed. 322 (1922)) the court held the state statute forbidding any mining of coal that causes subsidence of any house made it impracticable to mine coal and had the same effect as the complete destruction of property rights, thus constituting a taking. Penn Central, at 650 and 651.

The facts before the court in Penn Central dealt with the imposition of a landmark ordinance by the City of New York which effectively prohibited the owners of Penn Central terminal from developing the air space over their property. The ordinance also allowed for the transfer of development rights by owners of designated landmarks. The court in sustaining the ordinance and denying plaintiff compensation emphasized the fact that the owners of Penn Central had continued rights to the present use of the terminal, could obtain a "reasonable return" on its investment, and had an opportunity to develop other properties.

While the court did cite the availability of transfer of development rights in the Penn Central case, the thrust of the opinion is that the court will look at the specific facts of the case and the reasonableness of the regulation.

A recent 9th Circuit Court of Appeals decision dealing with height restrictions is especially instructive as to how a court would likely handle facts similar to those which could result from imposition of solar envelopes. In Haas v. City and County of San Francisco, 605 F.2d 1117 (1979), plaintiff invested almost $2 million to purchase property and to obtain development plans in reliance upon a site permit. The site permit was subsequently set aside for failure to comply with the California Environmental Quality Act. In the interim, the City Planning Commission revised the area height restriction downward from 300 ft. to 40 ft., and restricted the bulk which would be allowed in the area. Viewing the evaluation evidence most favorably to the plaintiff, the Planning Commission's action reduced the property's value from about $2 million to about $100,000.

The Ninth Circuit held that this did not constitute a "taking" as long as the restriction was reasonably related to the promotion of health, safety or general welfare and there was some economically viable use of the property remaining. One of the benefits to the general welfare specifically noted was the preservation of air and light for neighbors. The Haas case would therefore support substantial restrictions on allowable height and density as part of imposition of the solar envelope when the benefits are not only for light and air, but also for energy production.

To the extent that application of an envelope to a particular lot would so substantially reduce the value of the property as to constitute a taking, variance procedures could be utilized to alleviate the hardship otherwise imposed, and thus avoid a successful claim for damages. With use of variances for special cases there is every reason to believe that broad use of solar envelopes would be sustained and no damages would be awarded but the U.S. Supreme Court's ruling in Agins may well affect that conclusion.

2. Section 1983 of the Civil Rights Act As a Basis for Recovery of Damages

A landowner whose property has been restricted by local government regulation may file an action for damages claiming violation of the constitution and laws of the U.S., under the Federal Civil Rights Act. Local government and government officials, however, have certain immunities and defenses which can be raised as disccused below.

The Federal Civil Rights Act states:

> "Every person who, under color of any statute, ordinance, regulation, custom, or usage, of any State or Territory, subjects, or causes to be subjected, any citizen of the United States or other person within the jurisdiction thereof to the deprivation of any rights, privileges, or immunities secured by the Constitution and laws, shall be liable to the party injured in an action at law, suit in equity, or other proper proceeding for redress." 42 USCA and 1983.

Section 1983 provides a possible remedy when a person acting under color of State law deprives another of federal guaranteed rights, privileges, or immunities. A number of recent cases have held that damages may be recovered for excessive regulation of land under Section 1983. Lake County Estates, Inc., Tahoe Regional Planning Agency, 440 U.S. 394 59 L.Ed.2d 401 99 S.Ct. 1171 (1979); Richmond Elk Hall Assn. v. Richmond Redevelopment Agency, 561 F.2d 1327 (9th Cir., 1977). Rogers v. Tolson, 582 F.2d 315 (4th Cir. 1978); Cordero Development Corp. v. Santiago Vasquez, 539 F.2d 256 (1st Cir. 1976), cert. denied 429 U.S. 978 (1976); Simmons v. Wetherell, 472 F.2d, 509 (2d Cir. 1973); Amen v. City of Dearborn, 363 F.Supp. 1267 (D. Mich. 1973), rev'd other grounds, 532 F.2d 554 (6th Cir. 1976); Nasralah v. Barcelo, 465 F.Supp. 1273 (D.P.R. 1979); Gordon v. Warren 579 F.2d 386 (6th Cir. 1978). However, only in one case, Hotel Coamo Springs, Inc. v. Hernandez Colon (1976 DPR) 426 F.Supp. 664, were damages held proper.

Hotel Coamo involved a rather unique set of facts. Three million dollars had been invested by plaintiff in reliance on a planning Board authorization for development of a resort to be built around a famous hot springs owned by plaintiff. The Commonwealth of Puerto Rico thereafter declared the hot springs a public utility and condemned a portion, but not all of plaintiff's land. The Planning Board then denied plaintiff's proposed development. The Court, referring to plaintiff's vested right under Puerto Rican Law, held that an action for damages for the diminution of value of plaintiff's remaining lands would lie.

Application of the principle set forth in Hotel Coama appears quite limited, because of the unusual facts and the existence of a vested right under Puerto Rican law. A landowner who seeks the help of a federal court to secure damages in a Section 1983 action definitely has a heavy burden to carry. For example, while finding there was no blanket immunity for local government from monetary damages for inverse condemnation, one federal court in California noted that monetary damages are not judicially favored in land use cases absent physical invasion, regulations allowing no reasonable use, or confiscatory intent or bad faith.

> "Plaintiffs will therefore have a heavy burden of proving entitlement to monetary relief on the basis of excessive restriction, bad faith, or confiscatory intent ... "Sanfilippo v. County of Santa Cruz, 415 F. Supp. 1340, 1343 (N.D. Calif. 1976).

Assuming the plaintiff successfully contends that the restrictions imposed by application of the solar envelopes constitutes a taking or a denial of due process, the City and its officers could be sued for monetary, injunctive, and declaratory relief under section 1983 for a denial of constitutional rights, since a City is a "person" within the meaning of that section. Monell v. New York City Department of Social Services, 436 U.S. 658; 5 L Ed.2d 611 (1978). In its recent Owen v. City of Independence, Missouri (U.S. Sp. Ct., April 15, 1980) decision the United States Supreme Court removed even the limited liability and "good faith" defence for municipalities in action under Section 1983. Therefore, the City could be sued in federal as well as state court to set aside solar envelope restrictions. The Owen decision does not affect the limited immunity of individual municipal officials, protecting them from liability as long as they acted in "good faith".

To prove that a public official did not act in good faith "it is necessary to prove he or she acted with an impermissible motivation, or with disregard for clearly established constitutional rights." Woods v. Strickland, 420 U.S. 308 (1975). Such a case cannot easily be made.

The Woods case which established the "good faith" defense, sets forth the public policy reasons for qualified executive immunity which is that it is inevitable that when public officials act there will be some error, but it is better than that they not act at all. The appropriateness of this type of qualified immunity for executive officials has been recognized. Scheuer v. Rhodes., 418 U.S. 323 (1974); Navarette v. Procunier, 536 F.2d 277 (9th Circuit, 1976), afd, Procunier v. Navarette, 434 U.S.555, 55 L.Ed.2d 24; and Mark v. Groff, 521 F.2d 1376 (1975 9th Cir.).

III. Equal protection issues:

As long as there is a rational basis for the solar envelope classification, the fact that imposition of envelopes results in differential property restrictions, or that the envelopes are not applied to all properties, does not constitute a denial of equal protection.

Certain aspects of utilization of solar envelopes potentially raise equal protection challenges. The degree of restriction imposed by an envelope will depend on whether solar access is to be protected at the property line, at the adjacent building's rooftops, or some place in between. Assuming selection of a uniform criterion (e.g. protection of solar access at the adjacent property owner's lot line) different property owners will still experience varying degrees of practical restriction depending upon a number of facts, such as the orientation of their lot, topography, and whether the property is on the north or south side of a street. It is also likely that any action taken to impose solar envelopes would be taken gradually and initially limited to certain types of properties, such as those still undeveloped. The question thus arises as to whether a denial of equal protection might result from the uniform application of envelope criteria with differing results or from phased implementation.

We conclude that when standard criteria are imposed on like properties based upon a need to protect solar access to adjacent property, there is no discrimination as a matter of law. Phased implementation may also be sustained. Imposition of envelopes on relatively small, isolated parcels should, however, be avoided.

The general rule is that a land use restriction will be sustained against an attack on equal protection grounds as long as there is a rational basis for the classification created by the regulation based on the objective sought to be achieved.

The fact that two parcels of property similar in nature are zoned differently does not make the zoning unreasonable. Ensign Bickford v. City of Liermarze 68 CA3d 467, at (1977) 477. As the courts have consistently recognized, zoning necessarily involves drawing boundaries, and the legislative body's determination regarding the propriety of the boundaries may be attacked only if there is no reasonable basis for it.

> "Often there may be little difference in the character of the property on either side of the line, but such a showing will not justify a judicial alteration or extension of the boundary." Wilkins v. City of San Bernardino, 29 Cal. 2d 332 (1946).

"It is well established that similar characteristics in adjacent and surrounding areas do not necessarily preclude the zoning authorities from placing adjoining territories in different zones ..." Lockard v. City of Los Angeles, 33 Cal.2d 453, 465 (1949).

Important presumptions support the reasonableness of zoning actions even when challenged as constituting a denial of equal protection. For example, enacting a zoning ordinance is a legislative function, which courts treat as presumptively valid. "This presumption will not be overthrown unless the plaintiff produces evidence compelling the conclusion that the ordinance is, as a matter of law, unreasonable and invalid." Orinda Homeowners Committee v. Board of Supervisors, 11 Cal.App.3d 768. (1970). Further, the motive of the City Council in enacting the ordinance is irrelevant to an inquiry concerning the ordinance's reasonableness, except in those cases where the class is suspect, e.g. a racially discriminatory purpose was a motivating factor in the decision. Village of Arlington Heights v. Metropolitan Housing Development Corporation, 429 U.S. 252 (1977).

When envelopes are imposed on selected categories of property, or different types of envelopes resulting in varying degrees of protection of solar access are imposed on different types of property, questions of legality may arise. However, as long as there is a rational basis for the limitation it will be upheld. Consideration of feasibility such as the degree of prior development, or the energy savings which could result from restrictions in a certain type of development (e.g. multiple-family versus single-family residential) might form such a basis.

Applying the envelope only to one or a limited number of parcels of property under single or limited ownership could, however, be found to be discriminatory "spot zoning" and also might be treated as an administrative action.

Spot zoning is one of four general categories where zoning ordinances have been held invalid as applied to particular pieces of property. Illegal ordinances are those which attempt to: 1) exclude existing uses or businesses which are not a nuisance; 2) create a monopoly; 3) limit the property to uses which is entirely unsuitable because of the use of adjacent property; or 4) give a small parcel fewer rights than surrounding property, as where a lot in the center of a business or commercial district is limited to use for residential purposes. Wilkins v. City of San Bernardino, supra, at 340.

This last ground for invalidity is based upon a denial of equal protection. Almost all successful challenges to ordinances on equal protection grounds, with the exception of those with allegations of racial discrimination, have been where small parcels of property are treated differently than those in surrounding areas, and are thus "spot" or "reverse-spot" zoned.

For example, in Viso v. State of California, 92 Cal. App.3d 15 (1979) plaintiff alleged that his property was treated differently from surrounding property similar in from kind, character and condition. The court held that the allegation was sufficient to state a cause of action for declaratory and injunctive relief due to spot zoning and discrimination, though such relief was not granted for other reasons. In some cases, however, the challenged ordinances have been set aside. In Reynolds v. Barrett, 12 Cal.2d 244 (1938), the court set aside a zoning ordinance which restricted to residential use a single piece of property otherwise surrounded by business uses. As the court stated:

"It is obvious that by a zoning ordinance a City cannot unfairly discriminate against a particular parcel of land. The general scheme of zoning is found valid, nevertheless the court may properly inquire as to whether the scheme of classification and districting has been applied fairly and impartially in each instance ... Obviously, a City, purporting to act under its police power, cannot create a business district, and entirely within it create an 'island' of one lot restricted to residential purposes when no rational reason exists for such a classification. Clearly, and without possibility of doubt, such classification is discriminatory as to the isolated parcel, completely surrounded by business property." Reynolds, supra at 251.

Thus it would be imprudent for the City to impose solar envelopes on isolated parcels of property surrounded by unrestricted parcels. In that case, one of the factors the court might consider would be that the property would be burdened, without receiving a reciprocal benefit from adjacent property. While this fact alone would not cause an ordinance to be struck down, since the boundary must be placed somewhere, mutual benefit has been an important factor in the balancing process by courts which have sustained restrictive land use regulations.

IV. Legal Factors Related to Various Methods of Implementation

Numerous methods of implementation would be available should the City decide to experiment with the use of solar envelopes. In developing innovative responses to new social problems, such as the energy crisis, the courts allow reasonable latitude for experimentation. The right of a city to experiment with zoning has been specifically recognized by the United States Supreme Court in Young v. American Mini Theaters, Inc., 429 U.S. 873 (1976). A regulation is not to be challenged simply because it is novel or seeks to accomplish purposes not previously thought appropriate. Construction Industry Association v. Petaluma 522 F2d 897 (9th Cir. 1975). Nevertheless, some methods of implementation pose greater risks than others, and the legal impact of selection of an alternative must be considered. Therefore, several alternative methods of imposition are analyzed for their legal consequences.

A. Imposition through an amendment to the General Plan or a Citywide zoning ordinance.

The safest way to impose solar envelopes would probably be by an amendment to the City's General Plan, or by a zoning ordinance of Citywide application. If the General Plan is amended, the zoning ordinance should follow, since zoning in the City of Los Angeles must be brought into conformance with the General Plan by January 1, 1982. Chapter 304, Statutes of 1979. A uniform City Ordinance would not have to apply to all parcels in the City, but only to all like zones, e.g. all R-4 or commercial, or to all undeveloped parcels of property over a specified size.

As long as some economically feasible use of properties remained, or a variance procedure was allowed for those properties which would otherwise be left without such use, no insuperable taking problems would be presented under existing California or federal law.

With uniformity of application, there would also be no likelihood of successful equal protection challenge.

B. Imposition through community plans or by Council district.

Due to the experimental nature of solar envelopes there may be interest in applying the concept, if at all, on a more limited basis than Citywide. An appropriate method of implementation would be through amendment to local community plans.

Analysis of taking and equal protection questions would be essentially the same as with imposition through a citywide process: no significant problem should arise. Even though a type of property (e.g. R-4) in one community might be treated differently than a like type of property in another community, the need for responsiveness to local community needs provides a rational basis for such distinctions.

The idea of adopting a citywide ordinance to be triggered in specific districts by the affected Council member's request, or by full Council action, has also been discussed. There appears to be no rational basis for the difference in restrictions which would be imposed on like pieces of property throughout the City, and therefore this method is not recommended.

C. Imposition on limited parcels or through specific plans

Numerous practical and policy considerations may support limiting application to relatively small undeveloped parcels, such as the strip of open space along Wilshire or in Encino, or to specific plan areas.

Although there may be a rational basis for selecting undeveloped parcels or specific plan areas, care should be taken that unconstitutional "spot zoning" does not result. Application of land use restrictions to relatively small parcels of property under limited ownership should be avoided. A recent California Court of Appeals decision held rezoning of three contiguous properties comprising approximated 68 acres in the 10,000 acre city of Costa Mesa to be an administrative act which entitled the property owners to different procedural protections. (Arnel Development Co. vs. City of Costa Mesa, 79 Daily Journal DAR 151 (Nov. 9, 1979)). Emphasis was placed by the Court on the 68 acres being relatively small in the city of Costa Mesa, and the property being under limited ownership. An even larger piece of property might be considered "relatively small" in the City of Los Angeles. On December 24, the California Supreme Court, on its own motion, decided to hear the case. While the issue is thus not decided, the possibility of an action being treated as administrative rather than legislative should be considered in selecting parcels for regulation.

D. Use of variances

As previously noted, variance provisions are important safety valves to avoid successful challenges to envelopes on taking grounds where, but for a variance, there would be substantially no economic use of the property. Both case law and Charter provisions, however, limit the use of variances to situations where a property owner otherwise would suffer a hardship not shared by other property owners. Findings regarding the unique circumstances causing the hardship must be made and there must be adequate evidence in the record to support the findings. Topanga Association For a Scenic Community v. County of Los Angeles, 11 Cal.3d 506 (1979), and Los Angeles, Charter, S98(2)(b).

With the hardship requirement, variance procedures can be utilized for such purposes as excepting a property owner from normal set back requirements in order to allow development within a solar envelope if unique circumstances applicable to the property would otherwise result in a hardship being imposed. However, if numerous properties would benefit from the flexibility of varied set backs to facilitate solar access, City legislative action to allow "exceptions" under specified criteria should be utilized rather than a variance approach.

E. Application to Community Redevelopment Property

The California Community Redevelopment Act may affect the viable use of solar envelopes on community redevelopment properties. Since the City Attorney's Office does not serve as counsel for the Community Redevelopment Agency (CRA), we consulted with Murray Kane, attorney for CRA, who provided the following summary of practical and legal issues which might arise.

There are three types of properties within community redevelopment areas. First, there is property CRA purchases and sells for redevelopment. As to these properties, solar envelopes could be imposed in any plan area through the redevelopment adopted by City council ordinance. Redevelopment plans tend to be general in nature and thus a general statement of the criteria for protecting solar access would probably be appropriate. Whether or not a redevelopment plan included a requirement for protecting solar access by utilization of solar ordinances, the disposition agreement between CRA and the developer could contain such a provision. On disposition properties, CRA enjoys full architectural review and could readily enforce restrictions imposed by solar envelopes.

The second type of property within a Community Redevelopment area is that which is not purchased by CRA but is developed with approval of the agency. In regard to these types of properties, solar envelopes could be imposed in the development agreement.

The third type of property is that in a project area owned by private parties and for which there is no development agreement. For such properties, it would not be possible to impose solar envelopes by contract. The City Council could, however, through exercise of the City's police power, impose solar envelopes in the redevelopment areas. Such an exercise might be challenged on the ground that the exercise of this power is beyond the purpose of the redevelopment law to control blight. A contrary argument, however, could be made that the imposition of solar envelope benefits are justified to provide an opportunity for low-cost, non-inflationary solar energy. Should serious consideration be given to imposing solar envelopes through the community redevelopment process this question should be further explored.

V. Utilization of solar access zoning is compatible with, but does not fulfill the City's duties under the California Solar Rights Act of 1978.

A number of questions have arisen regarding the relationship between utilization of solar envelopes and the California Solar Rights Act of 1978. A comparison of the State Act's solar access provisions with the envelope concept makes it clear that the envelope is compatible with, but does not by itself fulfill the City's duties under the Solar Rights Act.

As previously stated, the declaration of purpose in the Solar Rights Act could be utilized to enhance any argument regarding the power of a City to utilize zoning to protect solar access for the general welfare. Beyond that, however, there is little correlation between the Solar Rights Act and solar zoning.

The Solar Rights Act addresses itself to a number of solar access problems. In summary, it does the following:

1. provides that the right of receiving sunlight over land may be attached to land as an easement, and defines a solar easement;

2. specifies the information to be included in a solar easement;

3. voids and prohibits covenants, conditions and restrictions which restrict or prohibit solar energy systems except for "reasonable restrictions" which do not significantly increase the cost of the system, or decrease efficiency, or which allow for an alternative system of comparable cost and efficiency;

4. prohibits cities and counties from enacting ordinances which restrict solar use;

5. requires the design of subdivisions for which a tentative map is required to provide, to the extent feasible, for future passive or natural heating or cooling;

6. authorizes cities and counties to require, as a condition of approval of subdivision maps, a dedication of solar easements;

7. modifies tax provisions regarding solar systems.

The provision of the California Solar Rights Act which are closest in purpose to the solar envelope concept are the provisions for maximum feasible use of passive solar in subdivisions and dedication of easements as a condition to approval of tentative tract maps. The first provision is mandatory, while the second is discretionary.

As a charter city, Los Angeles already enjoyed the necessary police power to require dedication of easements as a condition of approval of a subdivision map. The use of envelopes rather than solar easements would simply be a different method of accomplishing the same purpose.

As to the City's mandatory duty to require new subdivisions to provide, to the extent feasible, for future passive or natural heating or cooling opportunities, utilization of the solar envelopes would not necessarily meet the City's obligation. First, most of the discussion of solar envelopes has focused on protecting solar access for active solar systems. Passive cooling may be enhanced by shading rather than solar access. Further, solar access alone does not meet the City's duty under the Solar Rights Act as set forth in Government Code section 66473.1. That section states:

> "In providing for future passive or natural heating or cooling opportunities in the design of a subdivision, consideration shall be given to climate, to contour, to configuration of the parcel to be divided, and to other design and improvement requirements ..."

Orientation of lots and structures for new subdivisions must be reviewed, and it would not be sufficient to simply provide for solar access, although such provision would certainly be compatible with this mandating provision. Therefore, the City's fulfillment of its duties under the Solar Rights Act must be separately reviewed.

Conclusion

The City's report explores the potential and problems inherent in application of solar envelopes as a method of protecting solar access. Once the policy decision is made to go beyond State requirements in protecting solar access, the various alternative methods for doing so, and their legal implications, must be analyzed. The legal analysis section of this report has analyzed certain specific questions regarding solar envelopes. Other questions may occur that require analysis. Legal developments, especially in the areas of "taking" and immunity law affecting the analysis must be monitored. However, should a jurisdiction so desire, this report will hopefully provide guidance regarding the practical feasibility of using the innovative concept of solar envelopes to solve an important public energy problem.

VIII. STAKEHOLDER GROUP REPORT

(PREPARED BY THE MAYOR'S OFFICE)

The first meeting of the stakeholders group was held on Wednesday, November 6, 1979. In attendance were Richard Pearson, a civil engineer; John Curry, a real estate appraiser from the Community Redevelopment Agency; Al Bornstein, a developer; Bruce Merrit, an attorney; and Fredrico Grabiel, a solar consultant from the stakeholder group; Al Landini, Dave Gay and Paul Beard from the City Planning Department and Warren Williams from the Mayor's Office.

SUMMARY

There is a great deal of overlap in the concerns of the professional planning staff and the stakeholders group. Both groups were concerned with two issues: how should government be involved in solar access protection and would this involvement drive up the cost of building. Among the planners, administrative isues and the level of government involvement (not whether local government should get involved or not) were of primary concern.

Some members of the stakeholder group were less enthusiastic about governmental involvement altogether. Members of both groups were concerned with costs, but the developer invited to the stakeholder meeting (Mr. Bornstein) expressed particular concern.

Many of the concerns of the stakeholder group were highligted in two separate conversations staff had with two of the panel members: Paul Sheldon, a private energy consultant to governmental and community groups, and Richard Pearson of E.L. Pearson and Associates, Civil Engineers.

Mr. Pearson commented that he found himself wearing "two hats" when it came to solar access and development. The first hat was that of a civil engineer. According to his past experience, there wouldn't be substantial technical problems in establishing an envelope. An envelope for a 30-40 unit condominium, on a medium sized parcel would cost the developer between $400 and $800. This is compared to overall engineering costs of $3,000 to $4,000 for boundary lines, curb locations, utility siting etc. The plotting of other commercial structures, if the envelope had to take these into account, could increase this cost significantly.

If such an ordinance were to become law, many civil engineering firms would probably develop computer programs to do the routine angle calculations and would only have to plot the impact of surrounding structures by hand. Mr. Pearson felt, as does Mr. Knowles, that architects would translate this information into a series of longitudinal and transverse sections of the site. This is now done frequently to understand a sloping or irregular site. This would be a tool that would be inexpensive to obtain and easy to use.

When Mr. Pearson put on the hat of a land developer, he was not so optimistic. Even though the envelope would not be expensive to establish, it would represent increased costs to the developer in two ways. There will be increased design costs -- it will take the average architect longer to design around these new restrictions and come up with acceptable densities. There will also be some increased building costs for reasons mentioned elsewhere. These reasons, combined with a possible reduction in density when compared with existing zoning levels, are bound to anger the homebuilding industry.

The staff feels that the building industry in Southern California is facing a difficult challenge. Housing prices have been increasing faster than the rate of inflation in many areas, and the vast majority of the families who live in Southern California cannot afford a new house. Developers won't welcome anything that adds additional cost to these problems. Economic analysis which argues that many of these increases are due to increased land costs, speculation, and materials-labor price increase may fall onto deaf ears, as families are priced out of the market even further. Coverage in the real estate press claims that increasing government regulation and fees (particularly post Proposition 13) have been major culprits in recent price increases. Builders, faced with vocal public demands for affordable housing, may play on these sentiments to gain public support against solar access regulations.

Mr. Sheldon took a different point of view. As a private consultant he felt that some of the constraints being placed on developers were needed, if not always desirable. It is his view that the problems we are contributing to now, will be with us for a long time to come. While people must be able to afford housing in terms of mortage payments, the owners must also be able to afford the energy costs. These costs have been rising faster than the rate of inflation or mortgage rates.

Society as a whole must also be able to afford housing. New housing cannot place an undue demand on public services. Energy is becoming a more and more expensive service to provide and it should be used prudently. A house built so it blocks a neighbor's access to the sun and doesn't take advantage of solar energy itself may be less expensive to buy, but this house will also reduce the value of the property to the north of it by not allowing the property to use energy. The shaded house will be more expensive to operate over the life of the structure. Finally, the house that shades its neighbor will force investment in more energy sources and delivery systems than, if it had been built responsibly.

DENSITY AND COST

The solar envelope and solar access in general will affect the physical design of the city, but will it affect the density and economics of development? This issue was brought up by Mr. Bornstein immediately. Mr. Bornstein felt that the solar envelope would seriously change the current workings of the real estate market place. To begin with density increases with the size of the parcel under the envelope. He gave the example of two typical 50 ft. lots being worth $40,000 each. If the lots were side by side and could be assembled to form a larger lot the two combined would be worth $100,000 or more.

All of those present agreed that this incentive would exist. Mr. Williams noted that even though this point was valid there are already incentives for a developer to assemble land. Powerful economies of scale already exist for construction in terms of shared services and efficient use of labor. A ten unit project can be built for less than two five unit projects on separate lots. Mr. Bornstein agreed with these comments but felt that the warrant further study. (In a later conversation with Bob Sutton, a Planning Department official, it was brought out that density is altered under current land assembly. If a developer assembles two parcels and builds a single development, he no longer has to observe the setbacks between the two properties. This alone can add 10%-20% to the available density on some properties. ed.)

The solar envelope would not only alter the economic value of adjacent property but would also differentiate property by orientation. The specifics of this can be examined through looking at the 50-ft. lot. The solar envelope in a residential area is developed by giving access to the entire surface of all surrounding lots, except for shadow created by an eight foot privacy fence (p. 5-76: USC study). If it is assumed that the long axis of a building would be parallel to the street then sites on north-south streets can be developed to lower densities than sites on east-west streets. Most of those present were concerned that these average lots would become uneconomical for medium density development. (The frequency of these lots could be part of the evaluation of a specific plan area for envelope applicability. ed.)

ECONOMICS OF A NEW ARCHITECTURE

The designs done by the students at the University of Southern California suggests that the envelope concept may lead to new and radical urban forms. Some of this can be dismissed as student's flights of fancy, but building configuration must be changed, if a developer is to obtain maximum density. Mr. Bornstein expressed concern that the envelope would create an expensive style of architecture at a time the public was demanding "affordable" housing.

(There are several reasons why this style of architecture would be more expensive than present construction. If a developer wants to take advantage of the whole volume of the envelope he has two options. He can either slant the wall of the building itself or step the wall back as it goes up to approximate the angle of the envelope's side. The first option involves a large number of nonperpendicular angles (where the floors meet the slanted walls) which causes difficult fabrication and some additional materials waste. The second results in a large number of joints (with attendant weather-proofing problems) and a larger surface area (an exterior wall or roof is generally more expensive than interior walls). Set backs already exist in many areas, but the solar envelope frequently imposes more severe angles. This results in more difficult construction problems. ed.)

THE BENEFICIAL ASPECTS OF SHADING

Shading a building from the direct rays of the sun has many benefits, particularly in Southern California. Because of the high cooling load, significant energy can be saved if a building is shaded by trees or even another building. By enforcing a solar envelope on all buildings Mr. Grabiel questioned whether the city might be eliminating this beneficial shading. Mr. Williams reminded the group of a slide Mr. Knowles had included in the introductory slide show. The slide showed a building in Century City with the shadow of another building cutting diagonally across the building's facade. While the portion of the building in shadow was enjoying the benefits of shading, the portion in direct sunlight had to fight off solar gain. Even the most sophisticated mechanical system had difficulty dealing with such an uneven load.

Mr. Williams agreed that if a building could be guaranteed shading in a predictable manner then its energy demand might be reduced. However, the dynamic nature of solar access throughout the day and during the year makes this usually impossible. Furthermore, existing buildings may be replaced with new buildings which may no longer shade the project. (Two exceptions to these problems are separate buildings within one project or two parts of the same building. The regulations established by USC permit both of these conditions. ed.) Finally, new technology such as evacuated tube collectors may allow buildings to use solar energy to cool themselves. All things considered, Mr. Williams felt that it was better to allow each building to have access and then shade itself through good architectural design.

NATURAL LIGHT

Artificial illumination is one of the significant consumers of energy in most office buildings. In many large buildings this use alone accounts for 40% or more of the total energy consumption of the building. Furthermore for every two watts that is devoted to lighting, the building must use a watt of airconditioning to remove the heat created by the lighting. For these reasons, as well as other aesthetic considerations, there has been a renewed interest among architects in natural light.

Mr. Knowles brought up this issue when he explained the change he had seen in the students' approach to design while working on the project. As the students calculated the envelopes, they began to take solar energy and antural lighting "seriously". In most projects, these two factors became major design considerations. Most used light wells and atriums as part of their designs. In some cases, they even arranged their interiors so that most offices were only 30 ft. from a window, to take maximum advantage of the available natural light.

This approach is also being taken by architects in the real world. Mr. Knowles cited the new headquarters building being designed for the Tennessee Valley Authority in Chattennooga, Tennessee. In this building, the architects have designed a series of reflectors that will reflect light 100 ft. into the interior of the building. (In an article in the September 1979 edition of the AIA Journal the designers said that this technique could reduce energy demands from 20% to 60%, depending on what else was done, when compared to conventional construction. ed.) While the envelope itself doesn't require the architect or developer to use the sunlight which falls on the proprty, there was a general consensus that, like the students, architects would think "seriously" about natural lighting after plotting an envelope.

ZONING INCREMENTS AND THE SOLAR ENVELOPE

Traditional zoning classifies land by use and density. Even though zoning is designed specifically to separate incompatible uses and densities, there are always boundaries between zones where one density and use meets another. Depending on how fine the gradation is between zones, these changes can be obvious and even disturbing. For example, in many areas of strip development there will be high density commercial development on either side of the major street with single-family residential directly behind this commercial development. One of the clear advantages of the solar envelope is that it eliminates these sudden jumps in density (but not in land use).

Mr. Bornstein, who had just finished work with an advising committee on the Los Angeles County General Plan, noted that these discontinuties had been a major concern. Los Angeles County has traditionally had a zoning code which jumps abruptly from step to step. This has caused many problems in community planning and has created some problems with developers who attempt to fit projects into dissimilar surroundings.

While the Los Angeles City zoning code makes these transitions more smoothly, there can still be problems. As in the County plan, strip areas provide density contrasts from high density commercial to low density residential areas. It has been these areas that have caused the greatest problems in terms of citizen complaints and difficult planning decisions. The solar envelope will change this problem significantly. To begin with, it will make these transitions more smoothly by graduating the densities. In commercial areas each new building will relate to the buildings around it in shape and density. In residential areas, new projects may be significantly larger than existing development. However, as long as full lot solar access is required, the size of the project will usually be in scale to the existing neighborhood.

While most of those present agreed that this would improve the scale of the city, Mr. Bornstein brought up a serious problem with this approach. In commercial areas, where permitted density depends on existing buildings, the developer (or the city) won't know the exact possible density without establishing an envelope. This could make the whole process of land development much more uncertain for the developer and unpredictable for the city. (However, it is not clear at this time just how uncertain. After some experience with the envelope, it may be possible to make an acurate estimate of possible densities from a "visual survey" of the property and surround structures. ed.)

INCENTIVES FOR DEVELOPERS

In the last decade, there has been a great deal of interest in the creative use of incentives in the development process. One of the early proponents of this approach to the private market was Jonathan Barnett who spelled out many of the concepts in the book Urban Design as Public Policy. The central concept behind this approach is that a city urges developers to include public amenities in their projects by giving incentives which result in increased revenues to the developers. Mr. Bornstein brought up the idea that incentives would be one way of gaining the development community's support for the solar envelope.

There are two problems with this. To begin with, the incentive most frequently given to developers has been increased densities. In most cases, this cannot be done with the envelope. Because much of Los Angeles is overzoned, if the developer opted to use the envelope rather than existing zoning, he would face a reduction in density. In some areas of the city that have been severely downzoned, such as the area along Ventura Boulevard this could work, but there are very few of these areas (ed.).

In the past, density has been the usual incentive, but other approaches, such as parking requirements or setbacks, could theoretically work. Again, in the real world, other problems arise. There may be a few areas of low density where this would work but this would not solve a more serious problem with incentives. The envelope operates on the principle of each building not being allowed to block a neighboring building's access to the sun. For the developer to have any options, density and height restrictions must be low enough on the "worst" option so as to not allow any project to interfere with anyone else's access.

In other words, uniformity is still necessary. The highest and most dense project a developer could come up with, ignoring the envelope, cannot allow less access than a project designed under the envelope. The number of areas this could occur in the city, as zoned today, are small. Of course as the zoning is brought into conformance with the community plans under the state mandated zoning conformance program, there may be opportunities for this approach. Politically though, public officials may not choose to go through such maneuvers for a plan which must guarantee uniform access for all new development.

IMPLEMENTATION

The question of uniformity brings up the key problem of implementation. Mr. Knowles mentioned that a recent study by the Environmental Law Institute identified two key advantages of the solar envelope concept. First, the envelope guarantees future solar access for all development. Private restrictions only guarantee solar access for those who enter into agreements, and mandatory easements only guarantee access for new development. The envelope guarantees that no new development interferes with existing access (with exceptions such as the lower one third of the building or a building that only covers 10 percent of the lot) and when existing structures are torn down, their replacements must also not interfere with access.

Second, Mr. Knowles continued, the envelope concept is based as much on what each person will receive as what they will give up. (This quid pro quo is one of the most attractive things about the concept. Forcing everyone not to interfere with another's access to the sun says much more about the importance of solar energy, than forcing everyone to seek permission from their neighbors, to obtain it. ed.)

A second session of the stakeholders group was held at which the following areas were discussed.

SITE RESTRICTIONS

The first question to be brought up was in the application of the envelope concept to low density residential units. The question was:

> "Could the geometry of a single-family home - 18 feet at the plate (top of wall) and 26 feet at the ridge (top of the roof) accommodate south wall solar access?."

When these buildings are put on 1/8 acre lots, with mandatory five foot setbacks, there is very little latitude in building placement for proper orientation.

Mr. Bornstein pointed out that proper orientation was difficult enough in subdivisions, but almost impossible in infill situations where orientation to the street and other houses was predetermined. For these reasons, any high level of solar access was likely to increase costs and decrease density.

DENSITY AND PARKING

Denisty is a two edged sword. In areas with existing services, such as water, sewers, and utilities, density causes these services to be used more efficiently. On the other hand, increased density usually forces stronger and more fireproof types of construction. These types of construction are more expensive than low density and single-family home construction. In order to recoup these higher costs, a certain level of density must be achieved in the project. This level depends on the cost of money, land costs, labor costs, materials cost, and the profit margin demanded by the developer. (ed.)

Mr. Borstein conjectured that acceptable densities for most areas of Los Angeles could only be arrived at under the solar envelope by placing parking underground. This would free valuable space at the building's base (the level of the greatest volume) for dewlling units. While this configuration is practiced in some areas of the City, underground parking is still too expensive for most locations.

Mr. Curry added that parking could cost between $4,500 to $5,500 per space with some parking as high as $9,000 per space. While foundation costs might be reduced, this would only be equivalent to $3 - $5 per square foot of building or $900 - $1,500 per space. (Residential units in Los Angeles average $50 - $80 per square foot so this would represent a small overall savings. ed).

ENERGY COSTS

Are mortgage payments the only factor which determines home affordability? Mr. Sheldon brought up the point that while the expense of reduced density was obvious, there are also hidden expenses that this traditional point of view does not account for. There are some parts of New England and other colder climates where residents have fuel payments that exceed mortgage payments. Some panel members felt this point was not relevant because of the mild climate and low energy costs of Southern California. Other panel members pointed out that energy costs in Los Angeles have increased dramatically over the past few years faster than the rate of inflation. (As long as this is the case, energy would take an increasing part of the average family's budget. ed.)

THEORETICAL VS. DEVELOPED DENSITY

According to members of the City Planning Staff, much of the development that occurs today is less dense than that allowed by zoning. This is particularly true in residential areas where there may be up to a 20 percent disparity. (ed.)

Mr. Curry brought up some issues about this disparity and the costs and operation of the Community Redevelopment Authority. The CRA had informally down-zoned large areas of downtown Los Angeles to encourage what it felt were more realistic development projects and a more harmonious urban design.

For example, the Central Business District had been informally down zoned from 13-1 to 6-1 FAR. Bunker Hill (an area adjacent to the CBD with a lot of high rises), had been reduced from 13-1 to 9-1. The main reasons cited for these reductions were to reduce congestion and increase green space. It was also noted that some recent projects had exceeded these figures, getting up to 13-1 FAR in a development on Bunker Hill.

(The CRA has more flexibility than most of the private sector in making certain development economically feasible. This is not to say that land costs are not a significant factor in CRA development costs. Even in some redevelopment areas, land costs have doubled in the past few years to a level of $60 to $75 per square foot. Since they are a public agency and do not have to be concerned with profits or expensive private money to make site improvements they are able to offer land for sale or lease at reduced price. By reducing the selling price of land for projects where they demand less density, the CRA can provide effective incentives for design considerations such as open space, and if desired, solar access. Naturally there are economic limits to this approach, particularly after the recent initiatives on limiting property tax increases. ed.)

NATURAL LIGHT AS AN AMENITY

Even though most architects depend on artifical illumination to light their buildings, there is still a relationship between access to the sun and return on investment. Mr. Bornstein noted that while the solar envelope concept might be too extreme to provide a fair climiate for development, developers already had to consider many solar access and energy issues already. He cited an office building by the airport that was designed and built with unusually deep bays (the distance from window to the rear wall). The developers experienced great difficulty in filling the building even though it was located it was in a desirable area of recent growth.

Mr. Mutlow reiterated this point by citing apartment towers in the Marina del Rey area (a very desirable area of the City). North facing apartments in these buildings rented for $50 less than the units facing south because of a lack of direct sunlight. It was the general consensus of those present that most architects and developers have always had to consider the amenities natural light provided to the building user. Whenever natural light was available (though not necessarily direct sunlight) it was used as a selling point for the building.

NATURAL LIGHT AND ENERGY CONSERVATION

In addition to a natural light as an amenity, more and more attention has been directed as using natural light as a source of interior illumination. When directed and diffused it can provide an even, full spectrum source of free illumination. Even though natural light can cause additional air conditioning loads (the heat content of the sunlight itself combined with the poor thermal qualities of glass) there can be an net energy advantage if the building is designed well. (ed.)

Natural light can be particularly effective at reducing energy consumption in office buildings. (Up to 40 percent of the energy used in an office building goes into artificial light. ed.) The panel began discussing strategies for the use of natural light in a typical low rise office building. Mr. Mutlow noted that some reductions could be effected through the use of skylights alone. A further step would be the use of covered atriums to bring natural light into the lower floors of the buildings.

Mr. Bornstein reminded the group that interior curtain walls were less expensive than exterior curtain walls, but still not cheap when compared with uninsulated and minimally fire-rated interior partitions. In spite of this cost disadvantage, Mr. Bornstien noted that more and more "premium" office buildings were going to landscaped court areas but as an amenity feature rather than for an energy advantage.

PASSIVE SOLAR DESIGN

Sources as varied as the Solar Energy Research Institute and the authors of the Harvard Business School Report "Energy Future" cite passive solar energy as the most cost effective application for solar energy. Briefly, passive solar can be defined as using solar energy by taking advantage of the natural flows of heat and not resorting to mechanical sources of energy such as pumps or fans. It is likely that passive systems use many normal building elements such as windows, shades and masonry walls or floors for collection, control, and storage.

It is through dual use of these elements that passive systems gain their economic advantage. Passive systems may not be any more expensive than normal designs if the elements and materials of construction are the same. In general, to the degree that the passive design demands a different element or type of construction, the more expensive it will be when compared to normal construction. (ed.)

The next discussion focused on types of typical construction in the City of Los Angeles. Most residential construction is three stories or less (Mr. Bornstein) and usually Type 5 (Mr. Mutlow). (Type 5 is the most flammable of the grades of construction. ed.) Mr. Mutlow's experience has shown that passive solar design, while cost effective, is not cheap. (Type five construction is almost always simple wood frame with some fire resistant covering. Sine it has little significant mass of its own, it cannot absorb heat in sufficient quantities to prevent overheating of spaces during sunny periods or radiate heat when the sun is absent. ed.)

Mr. Mutlow pointed out that to create a passive design, some mass must be added to this light-weight construction. One typical approach for slab-on-grab construction was to use the concrete floor by painting it a dark color or covering it with a dark noninsulating tile such as quarry tile. If the designer had to resort to masonry walls or using water in tanks as a storage medium, then there would be increased material costs and additional trades would have to be brought on site. (These problems are amplified because of the threat of earthquakes in Southern California. Unless the floor is used as the storage medium these massive elements must be tied into the structure and heavily reinforced. This makes this type of construction more expensive than it would be in other parts of the country. ed.)

In spite of the concerns of the panel over the applicability and cost of passive solar design there are points of optimism. Up to now most of the passive houses have been single-family freestanding houses. However more and more attached condominiums and multi-family passive projects are being designed. As mentioned above, much of passive solar's price advantage is gained from smart design, i.e. using one element for more than one purpose. As architects and developers become experienced with passive design, innovative solutions will be found and costs will go down.

GOVERNMENT REGULATION AND THE DEVELOPMENT COMMUNITY

Many in the development community feel that developers have been faced with increased fees and regulation over the past few years. These regulations and fees, the theorgy goes, have been among the major reasons for increased housing costs. Mr. Bornstien felt it was time government asked itself whether these regulations were becoming counter-productive. While they may have provided protection in the short run, their long term effect on the city could create economic problems.

Mr. Sheldon disagreed with this viewpoint. While it's true that current development costs are rising, they should be compared with the life-cycle costs of owning a house (i.e. comparing investment with the savings on operating expenses over the life of the project). If these life-cycle costs look favorable, then perhaps the City has a social responsibility in urging and protecting these savings. This role is also justified from an economic point of view since these savings accrue to the City at large as well. This can be in the form of reduced pollution and in the case of a city-owned utility, reduced operating costs.

Mr. Bornstein agreed solar access might be proven to be in the public interest, but if it were, some sort of performance standard would allow more flexibility. (A developer could design a subdivision or infill project so that 100 square feet of roof space would receive sunlight for at least six hours on December 21. A law similar to this suggestion, has been passed in San Diego County, California. In this case a developer is exempted from the mandating ordinance if he can prove that he cannot find a building location that would give him 100 square feet of solar accessable area on the roof of the structure. Another approach would be to mandate that a certain percentage of the units be solar heated and have solar hot water. ed.) Mr. Sheldon agreed in principle but questioned whether this approach wouldn't cause a large number of exemptions and processing problems.

(While Mr. Bronstien's approach could work in subdivisions where the developer has design control over the whole area, infill would be a different problem. With infill, the problem is not so much finding solar access for your own development but blocking the access of your neighbor. Unless the developer is willing to also guarantee the same 100 square feet to the surrounding structures, the ordinance would not accomplish very much. Even if he is willing to do this, the surrounding owners may wish to eventually build a structure with an entirely different configuration that could require more or different access. Unless the city is willing to take a "first in time - first in right" approach, the problem is still not resolved. ed.)

IX. FUTURE RESEARCH ISSUES

1. The Solar Envelope Concept And Building Costs

a. Are there increased construction costs for buildings which conform to the solar envelope?

When talking to the professionals in several city departments, as well as experts from the outside, many voiced the concern that the solar envelope would create a more expensive style of architecture. In general, unfamiliar building procedures and unfamiliar appearances automatically drive up costs. First, because contractors do not know what to expect under the envelope concept in terms of building procedures and difficulty, the bids are usually increased. Second, the solar envelope creates a building which has a greater surface area than usual. If the building follows the slope of the envelope, it also creates a greater number of joints and irregular shapes in the building materials used. This may result in increased labor costs, increased material waste and fabrication problems. Exterior walls are usually more expensive to construct than interior walls, and costs will reflect this.

All of these factors may combine to create a structure which is more expensive than a traditional building. Whether the building will be moderately more expensive or dramatically more expensive is a matter of the skill of the architect doing the design, the skills of the contractor, and the other demands which the developer and the architect place on the building. Efficient design and an experienced contractor have always been able to minimize waste and come up with innovative and less expensive building procedures just as poor design or bad contracting can always increase the costs and difficulties associated with the project.

b. Are there other features which could reduce the cost of construction?

A second consideration is that the costs associated with rentable space construction are by no means the only costs associated with construction. For example, as Mr. Curry of the Community Redevelopment Agency pointed out in a stakeholder meeting, there are intricate relationships between parking and building costs. A parking garage that is also used as the foundation of a building may be less expensive to construct than a parking garage that is used independently, when the additional cost of the foundation is considered.

c. Can solar access encourage marketable amentities in office buildings?

As Mr. Bornstein pointed out in another stakeholder meeting, various emenities are included in buildings as selling points. While expensive to include, they represent marketing devices which allow the building to be leased earlier. Due to a current lack of vertifiable information, studies should be done on the relationship between the solar envelope and all building costs. All factors, such as the solar envelope's effect on parking, marketability of a building, and many other effects must also be taken into account.

d. What is the relationship between area wide life-cycle cost and construction cost?

Any analysis of the solar envelope and its effect on building costs should include an examination of energy costs for all buildings affected by the envelope. The solar envelope creates a physical design that allows other buildings in the area to enjoy more amenities, such as natural light, natural ventilation, and use of the sun's energy for thermal conversion. New research is being done, such as that done for the new Tennessee Valley Authority Headquarters in Chattanooga Tennesee, on how to take advantage of solar energy and natural light in commercial and residential structures. A prerequisite to the increased use of this energy and light is assuring its supply to a site.

The solar envelope would permit a building (if it is properly designed) to greatly reduce consumption of traditional sources of energy. Any study on the costs created by the solar envelope must be compared with costs of constructing and operating a "normal" building over its useful life. Estimates should be made of how much energy would be saved by the increased use of natural light and solar energy in present dollars as well as how much energy and money will be saved in the future. This analysis is not easy, nor is it entirely predictable, but to ignore it would be misleading.

e. Areas for further study:

- Increased costs of "step-back" design
- Off the shelf building systems which can accommodate step-back designs
- Marketability and life-cycle cost of buildings which use solar energy as an amenity or for energy conservation

2. Solar Envelopes versus Solar Easements and Other Non-Mandatory Solar Access Protection.

a. What is the rationale for making solar access mandatory?

Many of those interviewed from the Department of City Planning, as well as some of those consulted during stakeholder meetings, felt that solar access should be a voluntary matter--an agreement entered into by two private parties. This would make solar access a private agreement; regulated in the sense that the City would record an easement but participation is left up to individuals. This would reduce city enforcement bureaucracy and reduce governmental interference with the private sector.

Property developers have faced increasing restrictions and regulations on their developments. Environmental Impacts Reports, Subdivision Map Approvals, and Grading Permits are necessary but time consuming to development. Public agencies should justify new restrictions on development. Rather than just an issue of more or less government involvement it must be a question of equitable, even-handed, and necessary involvement. Under these criteria, solar access protection can be justified.

To begin with, solar access improves the quality of life for a person living on a piece of property. While this increased quality of life may be very hard to determine economically, there is little doubt that people put a priority on having the sun shine in their windows and increasing their overall access to the sun.

American society has not historically protected this access through legal regulations but this does not constitute a reason why this "right" should be ignored. As Robert C. Barrett says in the article "Overcoming the Solar Zoning Barrier: Katz versus Bodkin" regarding an early zoning regulation:

> "Its purposes were to achieve secure quiet residential districts with adequate light and air and secondarily to prevent congestion and haphazard development in all districts"

New York City's early zoning code mandated certain building setbacks to allow light and air into the cavernous streets of New York City that were being rapidly shaded by dense skyscraper development. While sunlight is not guaranteed per se by zoning, zoning has had a long influence in providing daylight and feeling of spaciousness in districts.

The right to sunlight becomes a matter of public policy primarily due to the potential for the conversion of that sunlight into useful energy forms. Our existing supplies of energy are becoming more and more scarce. We find that a delivered amount of energy from these traditional supplies is increasing in cost dramatically. This cost is not entirely reflected in the amount actually charged to the individual using the energy, but it is distributed throughout the society by a complex series of financial and environmental costs. Under these circumstances, it becomes a national priority to encourage the use of energy resources, reducing the need for traditional fossil fuels.

Solar access that depends on private agreements between individuals will be inconsistently available to the inhabitants of a city. Not all owners will choose to obtain easements for their own property nor give easements to their neighbors. Buildings designed without these considerations will be blocking solar access to their neighbors for the useful life span of that building, usually between 50 and 60 years. While the present owner of a piece of property may not desire or need solar access, the future owner may want solar access but its use will be precluded by the decisions made now.

b. Can a non-zoning approach be used to protect access?

Residential developments are frequently built up in large enough parcels that solar access can be planned and provided for privately throughout the development. In larger development areas, where many properties are being subdivided, private easements and covenants are a better alternative since their effect can be anticipated, and planned for, over the entire development.

However, in residential in-fill, which is now the majority of development that occurs in the City of Los Angeles, private agreements remain ineffectual because of their uneven application. They cannot, by themselves, create widespread solar access protection. The City of Los Angeles should examine all forms of solar access and apply each where it is most appropriate.

c. When can a non-zoning approach be used?

One approach is to use the least complicated type of solar access protection that guarantees a specified level of access. The City must be careful not to create guidelines for any type of access protection that are easy to implement, but do not guarantee solar access to the desired level. Another danger, as in the case of convenants and easements, is shifting the burden of enforcement from the city to the court system.

Studies should be done of the different types of access to compare their degree of difficulty of implementation, the burden of enforcement, the applicability to different densities and the overall level of solar access.

d. What is the principle planning advantage in using the envelope?

The most important planning advantages of the solar envelope is its ability to predict effects and allow for them in a cohesive manner. If solar access protection were provided for by private agreements, the owner of a skyscraper who wished to install a solar cooling system would have to seek easements from each of his neighbors individually. In a dense area this could be quite difficult as anyone who has tried to assemble properties will acknowledge. However, if a commerical district were seen as a whole, and the needs were determined for this particular district, then the solar envelope could control solar access very easily and uniformly. The solar envelope is precisely determined by the rules that would be developed to define it and nothing more.

e. Areas for further study:

. examination of non-mandatory protection in areas where heights are restricted and most buildings are built to the maximum height

. comparative costs of enforcing different types of access protection

. procedures for determining district-wide access needs

3. The Solar Envelope and Levels of Solar Access

a. Does the solar envelope reduce density per se?

There is much confusion over the solar envelope and the densities that are possible to achieve under it. Many people assume that the solar envelope is, by its very nature, more restrictive than other types of solar access protection. This is simply not the case. It must be emphasized that the density is linked to the level of solar access that is guaranteed, not to the method of guaranteeing this solar access. If the south wall of a building is protected from shading from 9 a.m. to 3 p.m. throughout the year, then the adjacent buildings's physical configuration must be restricted to the same degree under any type of solar access provision.

b. Why is there this confusion?

One reason people believe that the solar envelope is more restrictive is because the envelope creates a three-dimensional diagram of where one can and cannot build and still maintain solar access for the surrounding sites. The diagram may appear to be restrictive but it is, in fact, the very same diagram that would come about through any type of solar access restriction if it were drawn in a three-dimentional manner. It must be understood that as the tools of solar access are applied throughout a district in a cohesive manner, the access rules will result in a set of solar envelopes--it is as simple as that. What people may be depending on is that the high degree of solar access that is protected by the envelope will not be protected through the other forms of solar access protection. There is a need to correlate the levels of solar access with the implications for density on surrounding sites, regardless of the method of access protection.

c. Areas for further study:

- relation between levels of solar access and density

- examination of other factors, such as orientation, which can influence density and might be controlled by the "rules" of envelope generation

4. External Shading and Cooling Loads

a. Are there beneficial aspects in one building shading another?

Large office buildings face a cooling load year round, in almost every climate in the United States. One reason for this is the ratio of volume to surface area. As a building gets larger, the volume increases faster than the surface area. Internal heat (people, lights, etc.) must be exhausted constantly, regardless of external gain or loss. This factor multiplies the effect of the Southern California climate where most buildings, annually, have larger cooling loads than heating loads. It can be desirable if a building shades another building and reduces the solar gain. If this can be guaranteed, the building that is being shaded can use a good deal less energy for cooling purposes than it would otherwise. There is concern among some of the planners and some of the outside experts, particularly Mr. Frederico Grabiel, that the solar envelope concept would eliminate the beneficial aspects of one building shading another.

There are two problems with encouraging buildings to shade each other. To begin with, it is impossible to guarantee that any one building will permanently shade another building. Buildings are torn down and the beneficial apsects are lost. In addition, through sound design and technological improvements, there will be more and more ways of using the suns's energy to balance the negative effects of the sun shining on the skin of the building.

b. How can the sun be used to reduce cooling loads?

(1) The major load in many large buildings is lighting, which can account for well above 35 percent of a building's total energy use. Innovative design, such as in the Chattanooga TVA headquarters mentioned above, shows that there are ways of using natural light far more comprehensively than the current practice. This reduces the artificial lighting load and energy use in a building. The reduction of the artificial lighting load in a building also reduces the air conditioning load significantly (The rule of thumb cited by Richard Stein in the book Energy and Architecture, says that for every two watts of lighting that you reduce you can usually eliminate one watt of air conditioning).

(2) Technology exists which uses the heat of solar energy to cool buildings with absorption chillers. This technology is not now cost competitive with most forms of electrical or gas air conditioning, but may become so with rapidly rising utility rates and reduced costs of high temperature collectors. General Electric, among others, is testing high temperature evacuated tube collectors which could provide sufficient heat to drive absorption air conditioning. The important thing about these collectors is that they would not require tracking mechanisms to follow the sun. They could be placed on many surfaces of a building with only a small loss in efficiency.

c. Would using solar energy to cool a building change the access requirements?

These circumstances could change access priorities as pointed out in the HUD publication "Protecting Solar Access for Residential Development" (pg. 24). If solar energy is going to be used in commercial structures, in air conditioning for example, there might be different time limits provided during the day as well as different priorities given througout the year. Instead of being concerned about the winter shadows, there would be much more concern over solar access in the summer. In this case, access would be a good deal easier to guarantee because of the higher altitude of the sun in the summer sky. On the other hand, instead of just being concerned with a time period from 9 a.m. to 3 p.m. the times might be changed to 7 a.m. to 5 p.m. These times would be better because solar energy reaches the earth during the summer at much higher intensities in the morning and evening. Under these circumstances, the solar envelope would change significantly in shape. Whether it would change in overall volume would depend on several other variables.

e. Areas for further study

- net energy gain or loss when artifical lighting is compared natural lighting
- access changes for different technologies

5. Shading Public Open Space

a. How will the envelope change existing access in public spaces?

In the old Spanish grid of downtown Los Angeles (which is 45 degrees off cardinal direction), each street is given full solar access during part of the morning or afternoon, throughout the year. This is in direct contrast to the normal grid which is laid along the cardinal points of the compass. The latter grid denies sunlight to east-west streets during most of the year but allows sunlight on north-south streets every day of the year. The solar envelope will affect solar access on both grid systems. Developers are allowed to shade streets to gain density in both commercial and residential areas according to the USC rules.

This access denial could occur in other public spaces as well. There are planning and political problems in causing access to be denied to these public spaces by giving significant additional densities to private developers. This may not make a difference in some streets and open spaces that are not heavily used. Other heavily used streets and open plazas will have serious shading problems by this denial of solar access.

This brings up a major difficulty: solar access is most needed for open areas during the winter, when it is hardest to guarantee. One way of solving this problem is to establish a hierarchy of public open spaces by their relative needs of solar access. Public beaches, swimming pools and playgrounds may have a very high priority for solar access, where freeways, parking lots and other land uses may have a very low priority. The evaluation of public open space's priority to solar access should become part of the comprehensive analysis of open space.

b. Is there a way to use the envelope to increase access in public spaces?

Mr. Knowles has been consistently aware of this in the attention he has paid to public plazas and the relationship between use and solar access. In a climate like Los Angeles, people can use open spaces year round if they are provided with some direct sunlight during part of the day. Even in many harsher climates, people can use the open space for recreation on cold days of the year, if some solar access is provided. By modifying the rules of the envelope's generation, any level of solar access could be guaranteed. This is a major advantage of the solar envelope: solar access can be predicated and guaranteed to public open spaces as easily as to private residential or commercial properties.

c. Area for further study:

This information could reach planners and architects in the form of a workbook of open space alternatives. One effective method for organizing this workbook is Christopher Alexander's A Pattern Language. Such a workbook, while not directly tied to Ralph Knowles' solar envelope concept, would be easily implemented using the solar envelope.

6. The Solar Envelope and Predicting Density

a. Are there problems in predicting future density in an area when using the solar envelope approach?

One of the problems that planners will have the solar envelope concept is that it reduces the predictability of density in a given area. Planners will no longer be able to predict that an area will develop to a given dwelling unit density or a floor area ratio. Instead, an area will be in constant flux depending upon building activity and the rules of the envelope in that area. This makes planning of infrastructure and regional allocation of housing, recreation areas, schools, hospitals and other facilties very difficult.

b. What are the possible solutions?

First of all, an ultimate density limit could be set on development. For example, in the Encino area, a developer could build whatever the envelope would allow so long as he did not exceed a 3-1 FAR. This would in no way alter the effectiveness of the envelope as a solar access protection device. If this were done, the planners could assume, over a long period of time, that development in the area would reach that ceiling and not go any farther. This would put an upper limit on development and put a density limit on the evolution of the city over time and therefore would be one way of predicting the ultimate needs for the City's infrastructure. Of course no such limit would be needed in a residential area under the USC rules since full site access guarantees a maximum limit on density.

An alternative to this are evaluation methods on a district wide basis. These methods would predict what densities the solar envelope would allow in a specific plan area. This would be difficult and could require a computer program for execution. As mentioned above, in some areas, notably R-1 residential areas, where the solar envelope is dependent entirely on surrounding parcels and not on surrounding buildings, the densities are easy to predict given the size of lots, angle of streets, slope of ground, etc. These densities are of prime concern to the Planning Department for predictability of traffic loads, schools and other infrastructure for residential areas.

c. Are there special problems in predicting densities in commercial areas?

Envelopes in commercial areas provide more of a problem. If the envelopes were made responsive to surrounding buildings, as Mr. Knowles suggests, there is no "ultimate" limit on any envelope; it is only dependent on what's in the surrounding parcels. Nevertheless, in many areas the densities would probably tend to stablize unless there was rapid rebuilding or in-fill occuring. If the turnover in parcels is relatively slow then the growth of each potential envelope will be also very slow. In areas of high turnover, where each building is allowed to shade 30 percent of the newest building around, the growth in potential envelopes could be much more rapid. The time and density relationships that the solar envelope regulations set up need to be examined in much greater detail.

Similarily, the different regulations for generating the envelope should each be examined in relation to their impact on growth in density. For instance, if the height or number of stories of a building which are allowed to be shaded is fixed, then the envelope for each property becomes fixed. On the other hand if a certain percentage of an adjoining property's curtain wall is allowed to be shaded, then there is no ultimate limit; as the height of the wall grows, so does the height of the percentage available for shading. Many of these regulations could be evaluated on a matrix, defining each regulation according to its effect on density.

d. Areas for further research:

- imposition of an ultimate density over an area that is operating under envelope restrictions
- envelope/density approximation methods for residential areas
- relationship between method of access protection and change of density over time in commercial areas
- development and use of computer programs to define envelope

7. City Cooperation With The Private Sector

a. What is current status of city cooperation with the private sector?

The City of Los Angeles has a reputation of being relatively easy to work with where land planning and land development is concerned. According to Mr. Bornstein, City Planning officials go out of their way to make regulations clear to developers and are cooperative in helping developers seek creative solutions to problems in land development. This relationship should not be lost but should be encouraged. If the City attempts to implement the solar envelope in a district, this positive relationship will become more important than ever. In order to minimize difficulties, the City may choose to become involved in envelope determination. The City could do this either by graphic, numerical, computer aided, or sun machine analysis. The City should be careful of its involvements. This involvement could create additional expense and burden on the Planning staff.

b. How will the complexities of envelope determination interfer with this cooperation?

There will be major differences in envelope determination and regulations between areas. This will be a factor in how much the Planning Department can aid private developers. In cases of residential area, if solar access is to be insured for the entire lot, envelope generation becomes very straighforward. The only parameters are orientation, lot size, and whether or not the lot is on a corner. An envelope can be drawn readily because the limits to the envelope end at the lot line or across a public street. Mr. Pearson of E. L. Pearson and Associates, one of the stakeholders, indicated that a survey for a solar envelope on a small property might cost in the neighborhood of $500.

In cases of commercial structures, if shadow are allowed to be cast on existing buildings, envelope determination becomes much more complex and would usually demand an on-site survey. This survey would probably be done at the time the survey was done for the property. This could increase costs if existing buildings made the survey more complex. While commercial properties would have to be surveyed, many commercial developments are relatively complex when compared to residential development so that other costs are higher as well. These costs should be studied more. The relative expense of envelope determination compared with the costs of development should be examined so there is no special burden put on any one building type.

c. Areas for further study:

- a simplified methodology to allow developers and planners to estimate envelope configuration and density

- correlation between the cost of an envelope and the size complexity of a project

8. The Solar Envelope Concept and Transportation

a. Transportation and density are closely related; how will the solar envelope affect this relationship?

There is much concern over the effect that the solar envelope may have on other goals of city planning. One of the greatest concerns is the effect of the solar envelope on transportation decisions. To begin with, the solar envelope itself is no more or less restrictive than any other type of solar access protection, given the same levels of solar access. Therefore, this section will include an examination of the problems created by all types of solar access and their relationship to transporation.

b. Can the densities which permit solar access support mass transit?

Many people believe that solar access, per se, reduces density and therefore contributes to urban sprawl and mass transit problems of serving a greatly enlarged area. This is not necessarily the case. Solar access rules can be devised to allow very high density residential and commercial structures but these same rules will also guarantee a reduced access to the sun. The question is then, what levels of density are needed to make mass economics, of transportation are changing rapidly. What may have not been able to compete with the car in urban areas ten years ago may be very able to compete now. Innovative technology, such as light rail, may also make it economically possible to serve areas of reduced density with a form of mass transit.

Mr. Knowles has identified several ranges of building densities that the solar envelope can achieve. These ranges are moderate in density for urban areas and yet still allow a great deal of solar access to adjoining properties. To test these densities, a community could be examined then tested to see what kind of transportation and other planning problems this community creates.

c. Does the solar envelope support centralized or decentralized urban growth?

There are two archetypes in City Planning: the centralized vs. the decentralized city. The centralized concentric ring model of a city was identified in early studies of Chicago. The solar envelope seems to reinforce the differentation and hierarchy found in this model. In commercial areas there are relatively low levels of solar access and a relatively high level of building activity. In residential areas a greater level of access is guaranteed and therefore reduces the density. A rough diagram of this could be found in the concentric ring theory where the higher density at the center spreads out to lower and lower density at the edges.

One significant aspect of the solar envelope concept is that the concentric circles may not be symetrical. For example, the circles may only go out to the south, southeast and southwest to follow the patterns of solar access. Areas to the north of the high density areas, where shadows would be cast from these areas, would have to feature some land use that would not need as high level solar access but would be in low in height itself. Land uses such as industrial warehouses or other industrial buildings would be a possibility. These patterns of growth could also have a great impact on the transportation pattern and how growth would change the transportation sector.

d. How will the solar envelope affect the space set aside for the automobile in the city?

This is a very complex issue because of the space that the automobile takes up in the typical American city. For example, if it is assumed that major downtown buildings need substantial amounts of parking and that it is more economical to put this parking at ground level than below ground level, then the bottom one or two floors of parking for each of the buildings do not need solar access. The entire solar envelope really begins at an artificially determined plane above the actual street level. On the other hand, if it is determined that parking will be underground in an area then all envelopes must begin at actual ground level. It is a matter of determining rules that affect an overall neighborhood and holding to those rules when they genuinely protect the desired solar access.

The area of the city devoted to the automobile also represents an area of the city that can be shaded. This could provide increased density opportunities for property adjacent to it, i.e., properties on the street corners, adjacent to parking buildings, etc. Studies should be done to understand this relationship. One study could focus on how to allow the shading of parking structures and still not foreclose options for future building on that site that would require solar access. Secondly, detailed economic studies should be done of the relationship between the economics of the building and underground parking, parking above ground, or parking in a separate structure.

Finally, parking areas, because of their large size and the fact that they do not need solar access, are likely to face a different type of competition for solar demand. This could take the form of an effort to place active collectors on the parking lots themselves, and use the energy collected over the lot for the surrounding buildings. A recent experience in the City of Los Angeles with solar installation, where the solar installation was to go on a superstructure built over a parking lot, indicated that this is a very expensive way to go. A superstructure over a parking lot is simply not as economical as finding space equal in size on a building but may be the only alternative where no space is available in the surrounding buildings. The benefits and problems of shading parking lots with collectors are complex, and should be studied.

e. Areas for further study:

- correlation between ranges of densities which are practical under the different envelope rules and densities, needed to make various forms of mass transit efficient
- parking configurations (above ground, ground level, and below ground) and the effect on solar access
- feasibility of solar energy collection over parking areas

9. Physical Design and Energy Conservation

a. How will the solar envelope change the appearance of the city?

The solar envelope concept will change the appearance of the physical design of the city. The architecture will, in very general terms, be pushed out to the property line, sloped back away from the streets, in one direction or another and be lower than many of the new buildings found in cities today. The exact architectural and physical results of this are beyond the scope of the report. One thing that should be mentioned though is the relationship between these new buildings and the overall goals of energy conservation. Solar access both improves the quality of life and, if thermal conversion or natural light is taken advantage of, can reduce energy use of traditional sources.

b. Are there other building configurations which can conserve energy?

There are many other ways to reduce energy use in buildings. A normal townhouse, i.e., a house with two shared walls and a relatively narrow front and rear wall, could still use less energy per square foot than a free standing building that takes advantage of passive solar heating. Good orientation and south facing glass cannot always compensate for poor surface to volume ratios.

In commercial structures much of the annual load is air conditioning. Lighting accounts for a good portion of the remaining electrical load. A tall building, if designed to take advantage of natural lighting, and if allowed to use natural ventilation, may do quite well in terms of energy use when compared to a lower wider building that did not use these natural systems.

The important thing to remember is that the way a building uses energy, when considered from the source the point of use, is a very long and complex process. It changes tremendously over a 24-hour period as well as a over a yearly cycle. The evelope concept, for the first time, guarantees the opportunity to use natural lighting, solar thermal conversion and other renewable technologies to minimize the use of fossil fuel energy. However, the solar envelope concept does nothing whatsoever to create a energy conserving design, that is still the province of a skilled and talented designer.

c. Areas for further study:

- identify building prototypes which are energy conserving but, because of their configuration, would be difficult if not impossible to build using the solar envelope concept

- investigate how the solar envelope concept could be integrated with building code review and other city ordinances to encourage energy conserving building practices

10. Innovative Zoning Practices and Solar Access

a. Can other innovative zoning practices be used with the envelope to encourage solar access and energy conservation?

Over the past ten years many types of zoning innovations have been created, some of which may have application to this problem. One such practice is the transfer of development rights. This provision would permit a small building that did not need solar access to sell its solar access to a neighbor who wants to develop a building that would cast a shadow on the smaller building. This has many public policy implications as well as economic ramifications.

On the one hand, TDR's (Transferrable Development Rights) would make it possible for large buildings to develop in neighborhoods that are primarily low density and also permit large buildings to develop in neighborhoods which are primarily high density but with a few low density buildings. The USC report takes this into account by saying that all buildings that cover less than 10 percent of the property can be considered "temporary" buildings and therefore do not require solar access protection.

This 10 percent rule is arbitrary, but some form of development rights transfer for solar access could be a creative solution to this same problem. If one wanted to take development rights transfer one step further, one could even demand that private individuals that shaded public areas compensate the public by monetary compensation, by developing recreation areas on the roof of the building, or some other reimbursement to the public.

b. What are the problems in using TDR's?

The major disadvantage of this attitude is that once the decision to deny access is made, it is made for the life span of the building and is not revocable. Should a person decide now that he does not want or need solar access and he sells the development right, then he faces the danger of immense utility bills in the future and not having the alternative of using solar energy for relief.

One solution would be to allow a building to cast a shadow on property if the property owner receives a part of the energy collected from the building. The technology exists for this type of energy transfer now and will probably become even more feasible in the future as higher temperature collectors are perfected. Another solution would be for neighbors in a comercial or residential setting to band together and form a community based energy system which would collect and distribute energy on a block by block basis. Each neighbor's solar access would not be as critical as the block's overall access to the sun.

c. Does any type of zoning control allow for increased design control over an area?

The historic preservation district could be a very creative model for the establishment of a solar envelope and access district. The emphasis here would be to get neighbors to cooperate with each other in working out plans for district wide access. A major step would be to get architectural review committees and other advisory bodies in position to advise individual builders on how to save energy and use the solar access they get creatively.

An important element of the district use of solar energy would be an open space plan. Some open space would have access protected to ensure year round use while other spaces might only have access protection through certain times of the day. Such a district would also be an excellent trial case to examine the problems of solar access zoning in an actual community.

d. Is there any way to offer incentives to developers who use the envelope?

Another of the zoning innovations tried in recent years is the concept of various bonuses and incentives for public amenities. This concept developed in New York in the 1960's, is based on allowing developers increased height or bulk for the inclusion of public amenities in their projects. The theory is that the public gives up its right for a bulk limitation to obtain open plazas or commercial ventures, such as theaters or restaurants at ground level. This could be used with solar envelope zoning as well.

In the Encino plan, justification could be made to give up landscaped open space at ground level to obtain public access to landscaped recreation facilities on upper terraces of a building, if built in conformance to the solar envelope. The problem with any kind of incentive is that it cannot be an incentive for the solar envelope itself because the solar envelope, by definition, must be uniformly applied in an area. The solar envelope also eliminates height and bulk bonuses since the building must, at all cost, stay within the solar envelope.

e. Could parking be used as an incentive?

A possible incentive for use in solar envelope areas would be parking. If, in the Encino plan, an imaginary solar envelope is established on both sides of Ventura Boulevard, there are some interesting geometric considerations. The solar envelope on the north side of Ventura Boulevard would have to slope down sharply reaching ground level approximately at the property line to protect the residential developments immediately to the north. The envelope on the south side of Ventura Boulevard could cast a shadow entirely across Ventura Boulevard. The envelopes on the south side of Ventura Boulevard would be taller and larger than their counterparts on the north side. This configuration would allow walls that would be approximately 170 feet in height adjacent to residential properties on the south. In terms of urban scale this would be a poor solution.

One way out of this would be to create a zone between the residential properties and the commercial properties on the south side of Ventura Boulevard that would be used for parking structures. These parking structures would be lower in height than the commercial property while somewhat higher than the residential property, forming a transitional area. The size of the zone would be designed so that buildings on the north side of Ventura Boulevard conforming to the envelope could be approximately the same in mass as the buildings on the south side.

To encourage acceptance of the envelope concept developers would be able to buy into these parking garages. They could then use the area within their own buildings, that they would have had to devote to parking, for other commercial uses. Naturally, such an incentive plan would take a great deal of City coordination and would only be feasible in certain areas of the City.

If this "windfall-wipeout" concept were examined in greater detail, it might be done without public supervision. It could be accomplished through a series of agreements for parking arrangements between owners of property on the north and south sides of Ventura Boulevard. This would be helped along by the City providing maximum FAR's along the south side, which would give those developers who own property on the south side of Ventura Boulevard an incentive to use the space they could not develop into commercial areas for this "excess" parking.

f. Areas for further study:

- regulations to guide the transfer of solar access rights
- the potential for community wide solar systems to use in a "solar district"
- guidelines for design control in a "solar district"
- identification of incentives that would not interfere with solar acess
- identification of windfall/wipeout opportunties to distribute the negative impact of access protection

APPENDIX I

GLOSSARY

GLOSSARY--DEFINITIONS

1. ACTIVE SOLAR ENERGY SYSTEM - a system which requires the importation of energy from outside of the immediate environment: e.g., energy to operate fans and pumps.

2. ALTITUDE - the angle of the sun above the horizon measured in a vertical plane.

3. AZIMUTH - the angular distance between true south and the point on the horizon directly below the sun.

4. BEARING ANGLE - see azimuth.

5. COLLECTOR - any of a wide variety of devices used to collect the sun's energy for heating, electric generation, or to dissipate heat for natural cooling.

6. COLLECTOR ANGLE - the angle between the surface of the collector and the horizontal plane. A collector surface receives the greatest possible amount of sunshine when its orientation is perpendicular to the sun's rays.

7. COLLECTOR, FLAT PLATE - an assembly containing a panel of metal or other suitable material, usually a flat black color on its sun sides, that absorbs sunlight and converts it into heat. This panel is usally in an insulated box, covered with glass or plastic on the sun side to retard heat loss. In the collector, this heat transfers to a circulating liquid or gas, such as air, water, oil or antifreeze, by which it is transferred to where it is used immediately or stored for later use.

8. INSOLATION - the total amount of solar radiation--direct, diffuse and relected--striking a surface exposed to the sky. This incident solar radiation is measured in langleys per minute, or Btus per square foot per hour or per day.

9. INSULATION - materials or systems used to prevent loss or gain of heat, usually employing very small dead air spaces to limit conduction and/or convection.

10. LATITUDE - the angular distance north (+) or south(-) of the equator, measured in degrees of arc.

11. PASSIVE SOLAR SYSTEMS - any design, including space or structural components, and orientation, which enhance the natural heating or cooling of a building, without the use of external non-renewable power supplies.

12. RETROFITTING - installing solar water heating and/or solar heating or cooling systems in existing buildings not originally so equipped.

13. SETBACK - a distance from a lot or parcel line from which certain types of structures are prohibited or restricted.

14. SKYDOME (SKY VIEW) - the visible hemisphere of sky, above the horizon in all directions.

15. SOLAR ACCESS - access which protects reasonably placed solar energy systems from shadows blocking exposure to the sun during hours of high insolation, which are 9 a.m. to 3 p.m. local solar time.

16. SOLAR EASEMENT - the right of receiving sunlight across real property or another for any solar energy system.

17. SOLAR ENERGY SYSTEM - any solar collector, other solar energy device or any structural design feature of a building whose primary purpose is to provide for the collection, storage, and distribution of solar energy for space heating or cooling, water heating or generation of electricity.

18. SOLAR ENVELOPE - the largest volumetric container over a land parcel that allows solar access to all adjacent neighbors within useful time contraints.

19. SOLAR TENT - is a specific volume of airspace defined by a place sloping upward or the property lines at a specific angle from the horizontal, forming a tent over the property.

20. SOUTHROOF - the plane representing that portion of a roof which faces within $\pm$ 30 degrees of true south. In the case of flat roof surfaces; that portion of the roof used to support solar collectors or other solar devices for the collection, storage, or distribution of solar energy.

21. SOUTHWALL - the plane representing the wall of a structure which faces within $\pm$ 30 degrees of the true south.

22. THERMAL MASS - the amount of potential heat storage capacity available in a given assembly or system. Drum walls, concrete floors and adobe walls are examples of system with high thermal mass.

APPENDIX II

LITERATURE SEARCH

LITERATURE SEARCH

Any consideration by local governments of using solar energy for heating or cooling purposes in their jurisdiction necessarily involves a concern for access to sunlight by individual buildings. Here we look at a significant and representative sample of the literature on solar access in an attempt to bring some focus to these concerns. In doing this, the nature, development and trends of solar access discussions will be sampled. While there are numerous volumes on energy and solar mechanics, there are relatively few works on solar access. While the concept of solar heating dates to early Greece, solar access writings have only come to prominance in the 1970s. This report is a survey of the writings of solar access and does not represent classification of the literature.

Approaches to Solar Protection--General

The San Diego Regional Energy Plan states that "It is firmly established in this country that a landowner has no right to receive light over the land of his neighbor. The Doctrine of Ancient Lights, a rule of law providing for a prescriptive (or guaranteed) easement for light over adjoining land, is accepted in other nations as a part of the jurisprudential system, but has been consistently rejected in this country." (15, p. 141)

In view of this lack of "right to light", what actions can the City of Los Angeles take on behalf of its residents and businesses which need a guaranteed amount of sunlight to invest in solar equipment and expect a reasonable return on their investment. Eisenstadt and Utton, writing for the Natural Resources Journal, ask the following similarly unanswered questions.

What can a homeowner do if he spends a considerable amount of money for solar equipment and then the equipment is made useless or less than efficient by a building of his neighbors. (1) Does he have a right to sunlight? (2) If not, should the right be given to him (3) If yes, how?

Attempting to answer these questions, Martin Jaffee, writing for Environmental Comment, declares that the community must decide what level of solar access protection it is willing to provide to its residents. (6)

In another publication discussing the amount of solar protection, Jaffee and co-author Duncan explain that solar access development is completed only when it can be defined without affecting development beyond that desired by the community. (7)

In their Natural Resources Journal article, Eisenstadt and Utton try to clarify the local uncertainties about solar access explaining "Some areas of municipalities are not amenable to the solar rights concept. The prime example would be a downtown area zoned for high-rise buildings. Areas in which solar rights cannot or should not be created will differ from one municipality to another." (4, p. 392))

Miller, Hayes and Thompson in their Solar Access and Land Use: State of the Law, 1977 reinforce the need for local communities to remain flexible on solar access. "Several communities have studied aerial photographs of themselves and found that the roofs of nearly all homes are free of shadows during crucial periods. (12, p. 13) The authors continue to state the need for flexibility of protection methods; "Very dense central city area . . . . more bulk is allowed here than anywhere else, which may make it unfeasible to protection solar access . . . ." (12, p.20)

Given the need for a flexible well thought out program for solar access, how should the problem be approached? Peter Pollock, in his The Implementation of State Solar Incentive: Land Use Planning to Ensure Solar Access, states that "Legislation should respond to an actual or perceived need or barrier and not just be a demonstration of concern by the state." (14, p. 1) Pollock further suggests that, "Broad legislative grant of solar rights would seem to be questionable . . . ." (14, p. 6)

Differing in her approach to broad legislation, Ms. Gail Hayes, attorney for the Environmental Law Institute, speaking before the New York State Legislative Commission on Energy Systems, declared that a comprehensive solar access law should consider structures, vegetation, fences, signs and billboards. (13) Mr. David Engle, Director of Marketing Solar Heating Program for HUD, speaking before the same commission warned local governments of a need for reasonable solar access because few rights are ever absolute. (13)

Miller, Hayes and Thompson, in their Solar Access and Land Use, propose that in considering solar access protection, local governments would make a mistake if they focused on any one type of development by itself. (12) They were not opposed to solar access but were somewhat dubious of present approaches to the subject. "Existing legal approaches to solar access are of limited usefulness . . . . legal experts writing about this problem are nearly unanimous in agreeing that some sort of access to solar energy should be guaranteed . . . . " (12, p. 3)

Jaffee and Duncan writing their guidebook for planning officials Protecting Solar Access for Residential Development proposed a departure from strict standards for solar protection. They advocate a departure from traditional yard and setback requirements for a flexibility in siting that would allow greater solar access. It is their view that any strict standards, in one district may be too restrictive when imposed in another district or land use area. While their writing proposed greater solar access protection, Jaffee and Duncan recognize that ". . . . solar access may have to be sacrificed in order to meet other development objectives." (7, p. 80) The viewpoints put forth in their detailed discussion the alternative degrees of protection that might be considered by municipalities seeking to provide solar access protection. They consider topics such as rooftop protection vs. south wall protection and south lot protection. It is recommended that communities consider south wall solar access as a good objective.

In his statement concerning the degree of solar access protection before the New York State Legislative Commission on Energy Systems, George Johnson, Professor of Law at Brooklyn Law School, testified that protection should not be absolute. (13) If a developer wants to build a building that will cast a shadow on a neighbor, then he should be required to buy the rights to do so. Professor Johnson indicates that this approach would prohibit small buildings from stopping a large commercial or office highrise development. Ms. Gail Hayes, attorney for the Environmental Law Institute, speaking before the same commission stated that "legislation should only protect solar systems that are reasonably sized, located, angled and suited to the structure they serve, and suitable for their locale." (12, p. 27)

The City of Los Angeles, in a Planning Department report titled Property Owners Rights to Sunlight, recognized the need for an appropriate amendment to the City's General Plan which would provide for a City policy encouraging the use of solar energy and the need to protect rights to sunlight. The report states that " . . . it should seem to be essential that an individual landowner be afforded a reasonable guarantee that his 'rights to sunlight' will not be interfered with and that his initial capital investment in solar equipment will be protected." (9, p. 21) The report suggest that the specific plan methods developed by the City could be a means of fostering the solar protection sought by the City. The report further suggest that the City need not formally recognize sun rights but simply modify existing controls on setbacks, orientation of lots, and height controls to provide fundamental solar protection.

Solar Zoning

One specific method of solar protection, much advocated in the literature, is solar zoning. The Los Angeles City Planning Department Report titled Property Owners Rights to Sunlight states that, " . . . it is likely that the preservation of right to sunlight through zoning controls could be legally justified under the police power." (9, p. 91)

Eisenstadt and Utton, in their Solar Rights and their Effect on Solar Heating and Cooling, suggest that the zoning power has never been used with solar rights in the past simply because there has never been a need. They suggest that zoning would be a good approach because regulating building height and setbacks through zoning powers have long been accepted. The authors declare that, "Zoning ordinances which treat the problem (lawsuits for shading solar panels) before the lawsuit arises would be instrumental in encouraging solar use and would also eliminate the delay in solar development that could arise as a result of the first collector shading lawsuit." (4, p. 414)

Jaffee and Duncan, in their Protecting Solar Access for Residential Development, feel even stronger about solar zoning, stating that, "Zoning is one of the most important tools for use in regulating solar access." (7, p. 62)

Not all of the literature sees zoning as the savior of solar access. There will be problems as with any new legislation. In looking at the effects of solar zoning on property values in this The Implementation of State Solar Incentives, Peter Pollock declares that, "Zoning for the purpose of ensuring solar access may diminish the value of some property." (14, p. 910) Jaffe and Duncan also forsee problems with the solar zone but anticipate they can be worked out through the normal zoning functions of variances and nonconforming use permits.

The Solar Envelope

A further refining of the approach to solar access anticipates a subset of solar zoning. The limits, rules and type of solar zoning is discussed in some detail in the literature. Professor Ralph Knowles presenting his paper Solar Ethics--Urban Form before the Passive Energy Conference in Philadelphia in March 1978, describes the solar envelope as his answer to the complications of solar zoning. He defines the solar envelope in this paper as "the largest volumetric container over a land parcel that allows solar access to all adjacent neighbors within useful time constaints." (8, p. 94) The time constraints considered are 9 a.m. to 3 p.m. winter and 7 a.m. to 5 p.m. summer for Los Angeles, at 34 degrees N latitude. The hours have been amended for this report. In discussing his work with the University of Southern California School of Architecture, students designing structures within envelopes, Knowles listed several traits of the envelope.

The envelope may cause setbacks to develop automatically and they are anticipated to usually being used for parking, service or pedestrian access. Buildings tended to follow the envelope shape very closely in order to maximize density. While not a function of re-envelope, housing designs tended to be segmented into two halves separated by a court. (8)

The American Society of Planning Officials publication Land Use Controls to Protect Solar Access further discusses the envelope and a form of envelope zoning called bulk plan zoning. The bulk plan is simply a plane rather than a complete enclosure which a building must be prohibited from penetrating.

Subdivisions

Many proponents of solar access protection would rather attack the problem from the point of new and major construction. They forsee much greater opportunity to properly orient the streets, lots, and structures through the subdivision process. The subdivision process allows the natural energy systems and patterns that exist on any large building site to be studied.

The California Energy Commission, in its report Solar Access: A Local Reponsibility, enumerated several facets of solar access protection that should be considered during the subdivision process: South facing slopes receive much more sun than a north slope, thus denser housing should be on south slopes rather than north slopes. Properly planted trees can provide summer shade without blocking winter sun. In California, blocks should be oriented along streets runing east-west so that houses can have the major yard in the south. Flexible setbacks provide opportunity for good solar access. Height variations and street width also increase opportunity for solar access.

The American Planning Association publication by Jaffee and Duncan offers further suggestions for items to consider in the subdivision process: "Cluster multiple dwellings around sunny courts to create sun pockets; (7, p. 117) "Orient buildings on east west axis; (7, p. 122) Houses should have major yards in the south to allow full exposure to winter sun for solar heating." (7, p.175)

Professor Ralph Knowles in his descussion of the solar envelope concept suggest that building renovation, retrofiting and rehabilitation should be considered on blocks that are properly oriented to the sun and parcel assemblage and range or orientation for structures be considered for land units that are not properly oriented.

Martin Jaffee, in an article for Environmental Comments states, "There is no reason to believe that solar access requires large-lot development." (6, p. 13) Offering more thought for subdividers, Jaffee indicates that rooftop protection should be possible to provide anywhere as long as height limits are maintained in a uniform manner. In densely developed areas, Jaffee recommends that accessory structure setbacks should be reconsidered to prevent shadowing of adjacent solar skyspace. Finally, Jaffee recommends that shadow plans should be laid out along with site plans and Environmental Impact Reports.

Architectural Design for Solar Access

Good solar access legislation should be correlated with good solar design and energy conservation design practices. The AIA research corporation, in their Solar Dwelling Design Concepts, suggest that dwelling design, site design and solar zoning are complementary and should be considered simultaneously throughout the planning and legislative process. The AIA considers the thermal characteristics of a building as extremely important for the design of solar dwellings and that it should go hand-in-hand with solar access work.

The California Energy Commission estimates that given proper solar access and solar design, the following heating and cooling needs could be met by passive solar systems in Los Angeles: (1) standard house with shading, 24 percent cooling needs and 42 percent heating needs and, (2) a house with thermal mass, 86 percent heating needs and 100 percent cooling needs. (3, p. 5)

Edward Marzia thoroughly considers solar design in The Passive Solar Energy Book. A sampling of his design ideas include the following: "On the east, west and especially the north side of the building keep window areas small . . ." (11, p. 101) "more energy is consumed in the construction of a building than will be used in many years of operation." (11, p. 115) "The most effective method for shading south-facing glass in summer is with an overhang." (11, p. 251) The south facing exterior wall of a building should be a medium or dark color to absorb low winter sun while the roof shoud be a light color to reflect high summer sun. Mr. Marzia's book is essentially a text on the mechanics of solar heating that are basic to an understanding of the planning aspects of solar access legislation. He offers little discussion of solar access itself, but offers technical information on solar development and the designing of a passive solar system.

There are numerous books out on similar subjects and Mr. Marzia's book is included as an example to demonstrate the way a building is related to site, climate, local building materials and the sun. The book offers technical appendices for calculations, various charts and tools for estimating solar performance and placement of mechanical devices. The author stresses the advantages of a passive solar system; economic, architectural and comfort/health. He lists the greatest advantage of the passive solar heating system as simplicity in design, operation and maintenance. The greatest problem is one of control. The book considers building location, building shape and orientation, window location, appropriate materials, location of indoor space, the solar heating or cooling system itself.

Richard Stein, in Architecture and Energy, provides pertinent information for proper solar design for the architect. The book is a state of the art study of the planning and design methods for passive energy conservation that are not a focused issue of this report, but are of concern to an understanding of the solar access problem. The book discusses the need for computer analysis of tall buildings for energy efficency prior to issuance of permits. The author discusses trends that should be considered in design; "With the proliferation of air conditioning . . . the peak (electrical) usage shifted to summer afternoons . . ." (16, p. 199) . . . . the highest energy users (in office building) are the most minimally built of the speculative office buildings . . . ." (16, p. 60)

Miscellaneous Protection Methods

While the literature tends to stress the major zoning, bulkplane and envelope approaches to solar access protection, most of the writings briefly touch on alternatives.

The American Society of Planning Officials discuss performance standards which prohibit shading of a portion of a neighboring lot which would be the most likely and logical location of a solar collector. Incentive zoning for solar provisions is also briefly discussed in the Society's draft handbook. Other suggestions include: "Community Plans should be re-examined in light of the need to provide solar access to as much land as possible." (2, p. 57) "Establishing transitional zone of gradually decreasing height maximums between high-and-low-rise zoned would improve solar access." (2, p. 57)

The Los Angeles City Planning Department Report Property Owners Rights to Sunlight, discusses alternative methods of protecting solar rights such as code amendments to provide step down heights and buffers; the utilization of transfer of development rights; the existing City configuration of zoning and height district.

Maullin and Sheehy, in Solar Rights in California, suggest covenants may prove to be more durable than zoning ordinances, which are subject to amendment. (10)

Eisenstadt and Utton, in their Solar Rights and Their Effect on Solar Heating and Cooling, suggest that "The concept of exchanging solar rights can be extended to entire neighborhoods." (4, p. 378)

One of the more definitive works on the approach to be numerous to solar access protection methods, is by Jaffee and Duncan Protecting Solar Access for Residential Development: A Guidebook for Planning Officials. Most of the various methods are discussed in some detail as well as an outline for developing a solar access program on the local level. "The first step is to remove barriers in local land use controls and plans to encourage private decision to proceed. Next . . . modify only those types of policies and regulations which are likely to have the greatest immediate effect on solar energy use and solar access. Finally . . . consider comprehensive changes to local regulations and plans to promote or even to mandate solar energy use and solar access protection. (7, p. 122)

APPENDIX III

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APPENDIX IV

CURRENT RELATED CALIFORNIA STATE LEGISLATION

ASSEMBLY BILL No. 3017

Introduced by Assemblyman Naylor

March 6, 1980

REFERRED TO COMMITTEE ON RESOURCES, LAND USE, AND ENERGY

An act to amend Section 905.1 of, and to add Part 2.5 (commencing with Section 896) to Division 3.6 of, the Government Code, relating to land use regulation.

LEGISLATIVE COUNSEL'S DIGEST

AB 3017, as introduced, Naylor (Res., L.U. & E.). Land use regulation.

Under existing law, where a person has been injured by the imposition of restrictions on the use of property by a public entity, the person may seek relief from such regulation. Existing law generally provides for such relief with respect to regulations which involve an unconstitutionl deprivation of property without just compensation.

This bill would provide that a property owner would have a cause of action for relief with respect to a regulation or act of a public entity which destroys or substantially impairs its value or use, severely impairs its marketability or economic return, or substantially interferes with a property right.

Relief could include equitable or monetary relief or revision of the regulation or act by the public entity, and could include interim damages.

The bill would define various terms and include criteria to aid in determining if an act or regulation has a subtantial economic effect, and whether relief should be granted.

Vote: majority. Appropriation: no. Fiscal committee: yes.

State-mandated local program: no.

The people of the State of California do enact as follows:

SECTION 1. Part 2.5 (commencing with Section 896) is added to Division 3.6 of the Government Code, to read:

PART 2.5. Substantial Impairment Compensation

896. (a) The Legislature hereby finds and declares that land use control and regulation, and the fair distribution of burdens generated by such land use control and regulation, are matters of compelling public interest.

(b) The Legislature further finds and declares that vigorous and intelligent emloyment of land use regulation and control by California entities empowered therewith, to protect the environment, natural resources, and ecosystems, to control growth, and to insure sound land use planning, is in the public interest, but that such employment unaccompanied by a plain, speedy and adequate means of just distribution of the burdens generated thereby often results in imposing unjust, unfair, and often substantial economic burdens on individual property owners for the benefit of the public as a whole.

(c) Therefore, it shall be the policy of this part that adverse economic consequences and burdens proximately resulting from the imposition of land use controls and regulations shall be distributed coextensively with the benefits generated by the particular land use regulation or act in question, so that no person shall be required to assume more than a fair share of such economic consequences and burdens.

(d) Payment of just and adequate compensation to the property owner, in accordance with the provisions of this part, is a fair and preferred means of distributing the economic consequences and burdens in question.

896.1. If the economic effect of a regulation or act of a public entity upon real property is to destroy or

substantially impair its value or use, or severely impair its marketability or economic return, or substantially interfere with a property right, a cause of action in the property owner vests when such economic effect occurs.

896.2. The following definitions govern the construction of this part:

(a) "Regulation" means any written enactment or expression including, but not limited to, a legislative act, ordinance, resolution, initiative, referendum, policy statement or other governmental action involving the exercise of the legislative power of the enacting entity imposing or altering restrictions, limitations or conditions on the use of land.

(b) (1) "Act" means any other action of a regulatory entity, whether formal or informal, whether affirmative or negative, whether written or not written, whether involving or not involving the police power or legislative power of the entity, and whether initiated by the entity itself or accomplished in response to a referendum or initiative, or a petition, application, motion, or other act of a property owner, and shall include, among other things, the enactment, granting, refusal, or denial of a change of zoning, permitted use, variance, subdivision rights, or building or other permits, or any other official act, prohibition, representation, or policy affecting the value, marketability, use or economic return of real property.

(2) For purposes of this part "act" also means a public entity's failure to act in response to a landowner's application for a zone change or other change in land regulation, or in response to a landowner's application for a permit.

(c) "Permit" means any governmental approval required by law before an owner of land or any interest therein may improve or sell his land, or otherwise put it to use.

(d) "Property" includes any interest and right in real property, including but not limited to the rights to possess, use, encumber and dispose of the same.

(e) "Property owner" means any person holding any

interest or right, whether legal or equitable, described in subdivision (d) in any real property in the State of California.

(f) "Litigation expenses" means litigation expenses as defined and described in Section 1235.140 of the Code of Civil Procedure except that "property owner" shall be substituted for "defendant."

(g) "Public entity" has the meaning set forth in Section 811.2.

(h) "Interim damages" means reasonable costs, expenses and losses incurred between the time a cause of action vests as described in Section 896.1, and the time the property owner is compensated for the taking or damaging of his property as herein provided, which are proximately caused by the regulation or act above described, necessarily incurred and actually suffered, realized or expended, but which are not actually reflected in an award based upon diminution of value of, or damage to, real property, and which are not litigation expenses as defined in this part. Interim damages shall include, but shall not be limited to, ad valorem taxes paid, interest paid, and rents paid or actually lost.

896.3. (a) In determining whether the economic effect of a regulation or act is substantial, and whether relief under this part should be provided, a court may consider, among other relevant evidence, the following:

(1) Diminution in fair market value of the property, both in percentage terms and in terms of the actual monetary loss.

(2) The regulatory status, zoning and use of adjacent properties, and otherwise comparable properties in the same geographic area.

(3) The reasonable economic expectations of the property owner. Whether such expectations are reasonable is to be determined using objective criteria.

(4) Any acts, omissions, policies or representations of the entity or its officers, employees, representatives or agents which, considered in their full factual context, impose a direct legal restraint upon the property or tend to show an intent to acquire or appropriate the property

for public use or benefit.

(5) Whether the regulation or act was accompanied by oppressive acts, unreasonable delay by the entity or its agents, or representations of the entity or its agents upon which the property owner reasonably and detrimentally relied, whether or not the agents have authority to legally bind the entity.

(b) Evidence supportive of the property owner's contentions in any one of the areas listed in subdivision (a) shall not conclusively establish a compensable taking or damaging, but shall be persuasive toward such a finding.

896.4. An owner of land affected by a public entity's regulation or act, as provided in Sections 896.2 and 896.3, shall be entitled to judicial relief in the manner provided in this section. The trial of any action brought pursuant to this part shall be bifurcated as follows:

(a) The court shall first determine whether the property of the plaintiff has been taken or damaged by the regulation or act, within the meaning of Section 19 of Article I of the California Constitution. If the court so determines, the cause shall be deemed an ordinary inverse condemnation action, and submitted to a jury for the determination of just compensation, and judgment shall be entered on the jury's verdict.

(b) If the court determines that no taking or damaging within the meaning of Section 19 of Article I of the California Constitution has occurred, but that the owner is entitled to monetary relief under the provisions of this part, the court shall make an order so finding, whereupon the defendant public entity shall have 120 days from the notice of such order to elect to do either of the following:

(1) Withdraw, vacate or rescind the offending regulation or act, or correct or amend it to remove its offending aspect or aspects, and pay the property owner for his interim damages and litigation expenses.

(i) The correcting of the act or regulation may be by amendment, by repeal, by granting the use earlier denied through permit variance or otherwise, or in any other appropriate way.

(ii) If this course of action is selected, the court shall retain jurisdiction and review the corrective act of the public entity. If, in the judgment of the court the proposed corrective act does not provide adequate relief or do substantive justice to the property owner, the court may treat such failure as an affirmation of the regulation or act, and proceed as provided in subdivision (d)

(2) Affirm the regulation or act and take the economic consequences thereof, as set forth below.

(c) If the entity takes no action within 120 days of the finding described in subdivision (b), it shall be deemed to have elected to affirm the regulation or act as a matter of law.

(d) If the entity affirms its regulation or act, the trial shall continue. In the second phase of the trial, the jury, or the court if a jury is waived, shall determine both of the following:

(1) The value of the entire property interest owned by the plaintiff, which is the subject matter of the action.

(2) The amount of damages actually suffered by the plaintiff, proximately caused by the regulation or act, not including interim damages.

(e) If the entire property interest which is the subject matter of the action is less than the full fee interest in the property in question, the defendant entity may request the finder of fact to determine the value of such full fee interest, in addition to the two determinations mentioned in subdivision (d).

(f) Once these determinations have been made, the defendant entity shall have 90 days to elect to (i) pay the property owner the damages as determined under paragraph (2) of subdivision (d), plus interim damages and litigation expenses, (ii) pay the amount determined to be the value of the property interest as determined under paragraph (1) of subdivision (d), or (iii) if the property interest is less than the full fee, and the fee value has been determined, pay the value of the fee interest as determined under subdivision (e). If the entity chooses to pay the full value of the fee or lesser property interest, the court shall order the plaintiff to convey all his right,

title and interest in the fee or lesser property interest, as appropriate, to the entity, and award the property owner interim damages, court costs and litigation expenses.

(g) If the entity does not make the election described in subdivision (f) within the time period specified, the court shall enter its order and judgment awarding the property owner the damages as determined in paragraph (2) of subdivision (d) plus interim damages, court costs, and litigation expenses.

896.5. Either party in an action brought pursuant to this part shall have a right to trial by jury. All questions of fact, including but not limited to those relating to liability and compensation, are to be determined by a jury, and all questions of law are to be determined by the court.

896.6. This part is not intended to create a cause of action for any of the following:

(a) Insubstantial or de minimus economic impairment caused by a regulation or act of a public entity.

(b) Damage caused solely by good faith general or preliminary planning function of a public entity, unless such planning, in the context of all pertinent facts and circumstances, results in substantial impairment to the marketability of the subject property, or is accompanied by a direct legal restraint on the property, or oppressive conduct or unreasonable delay by the entity.

(c) The refusal of a public entity to affirmatively confer a benefit upon a property, not enjoyed by surrounding or comparable properties, or to confer a benefit increasing the property's market value beyond that of surrounding and comparable properties, unless such refusal, in the context of all pertinent facts and circumstances, prohibits reasonable use and development.

(d) The regulation, control, or abatement or any nuisance or similar noxious activity or land use that is inimical to public health or safety; provided, however, that this provision shall not be applicable to lawful activities or land uses that are in themselves not harmful to public health or safety and are sought to be abated

solely to transform the use of the affected land to a more publicly beneficial use.

896.7. The provisions of this part shall only apply to causes of action which vest on or after January 1, 1981.

896.8. The provisions of this part shall be liberally construed to effectuate its policy of fair distribution of the economic burdens generated by public improvements as set forth in Section 896.

896.9. The relief provided for by this part shall be cumulative and available in addition to any other relief provided by law.

The provisions of this part shall be severable and if any phrase, sentence or provision of this part, or application thereof, is declared to be contrary to the Constitution of the State of California or of the Constitution of the United States, the remainder of this part shall remain in full force and effect, and apply to all entities, persons, properties and circumstances in relation to which it has not been expressly invalidated.

SEC. 2. Section 905.1 of the Government Code is amended to read:

905.1. No claim is required to be filed to maintain an action against a public entity for *relief pursuant to Part 2.5 (commencing with Section 896) or for the* taking of, or damage to, private property pursuant to Section 19 of Article I of the California Constitution.

However, the board shall, in accordance with the provisions of this part, process any claim which is filed against a public entity for the taking of, or damage to, private property pursuant to Section 19 of Article I of the California Constitution *and may so process a claim for relief made pursuant to Part 2.5 (commencing with Section 896)*

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APPENDIX V

OTHER OPTIONS FOR SOLAR ACCESS PROTECTION

V. OTHER OPTIONS FOR SOLAR ACCESS PROTECTION

There are numerous other methods available for solar access protection in Los Angeles. To properly evaluate the worth of the solar envelope concept, these alternatives must be reviewed. This section outlines these alternatives and the staff's perceived impacts and implications.

1. EXISTING PLANNING AND ZONING REGULATIONS

Inherent in this alternative is the assumption that existing zoning regulations, height district and special building height limitations are adequate to reasonably assure property owners' rights to sunlight. The present height limits applying to buildings in the City of Los Angeles were, for the most part, established pursuant to a 1956 Charter change which repealed the existent 150 feet height limit. These regulations and subsequent amendments were established in keeping with the "purpose section" of the Code to "... provide adequate open spaces for light and air... " Although the regulations could be interpreted to include sunlight, there is no direct reference thereto contained in the Code.

A. Present Height and Bulk Limitations

In all of the agricultural and single-family residential zones, and in the R2 and RW Zones, buildings or structures are now limited to three stories or 45 feet in height, regardless of the height district which may apply. Buildings in the R3 and RD Zones which are classified in Height District No. 1 are similarly limited to three stories or 45 feet, while buildings in the CR Zone (regardless of Height District), or in the RD and R3 Zones when in Height District), or in the RD and R3 Zones when in Height District Nos. 2, 3 or 4, are all limited to six stories or 75 feet. Except for other special limitations (discussed below) building "bulk" in other zones is regulated primarily by the specific height district applying to property. In height district Nos. 1, 2, 3 and 4, the gross floor area of a building may not exceed 3, 6, 10 and 13 times, respectively, the buildable area of the lot.

Two special building height limitations have been incorporated in the Zoning Code during the past 15 years in order to meet special situations which arose relative to the permitted height of buildings. These special limitations could be particularly relevant to the subject or solar access. The two regulations in question are the "I-L" - Limited Height District (established by ordinance in 1965) and the "1-VL" - Very Limited Height District (established by ordinance in 1974).

Enactment of the "1-L" provision which limits the height of buildings regardless of the zone to six stories or 75 feet, was designed to "bridge the gap" between the specific three-story limitation then applying in the R3 Zone and the unlimited heights of the R4 and less restrictive zones. Only the aforementioned floor area (bulk) limitation previously applied in these less restrictive classifications. The need for such a special height limitation was emphasized by several property owners groups in various parts of the City where the possibility of high-rise residential or other development presented a threat to adjacent single-family or other low density residential development.

Enactment of the "1-L" provision provided an added degree of flexibility by introducing a needed intermediate height limitation which could be applied in combination with any zone where good zoning practice would suggest limiting building heights in order to be more in scale with the development of adjacent areas. The limitation has since been effectively used on several occasions, particularly along segments of Ventura Boulevard and in West Los Angeles. The "casting of shadows" was a consideration in the actual zoning application of the "1-L" limitation in several of these cases.

The "1-VL" limitation, restricting buildings to three stories or 45 feet provided an even further degree of flexibility in controlling the height of buildings where other Zone/Height district combinations would otherwise permit higher structures. The proposal to establish such a limitation was initiated directly by the City Council in order to mitigate the adverse effects resulting from extreme height differences between adjacent structures, and particularly where commercial or high density residential zones adjoin single-family neighborhoods.

Application of the 1-VL limitation is particularly appropriate where existing zoning patterns are such that a potential "wall" of high-rise commercial buildings (otherwise controllable only by floor area to lot ratios) could adjoin low density and low height residential properties. It can, of course, also be used where commercially zoned centers, or industrial used properties adjoin existing medium density residential development. The "1-VL" provision is also a very necessary and appropriate tool available for implementing adopted community plans, many of which specifically call for three-story height limitations as an integral part of future land use considerations.

Enactment of these special amendments would indicate that subsequent to the Charter amendments of 1956 affecting building heights, the City of Los Angeles has been able to adequately respond to the specific need for changes in building height controls. These changes, enacted through amendments to the Zoning Code, have occurred primarily to meet new requirements occasioned by changing circumstances.

Environmental Implications - None of the building height regulations previously discussed (including the "1-VL" limitation enacted in 1974) has required the preparation of an environmental impact report. However, a determination as to the need for an EIR is made whenever the initiation of a change of zone or height district is made on specific properties. In addition, EIR's are routinely required in connection with the preparation of community plans, many of which call for future modifications in prevailing zoning and/or building heights throughout the City and would appear to be adequately addressed through the environmental review process.

Sociological Implications - As indicated, the existing citywide pattern of height districts was established following a 1956 vote of the electorate to repeal the old 150 feet height limit. Subsequent amendments to the Code establishing a special height limitations were enacted primarily as a result of the initiative of citizens and property owner's groups. These special limitations were then applied to individual properties after public hearing and in accordance with legislative procedure, as the specific need arose. Should these existing height districts and special regulations be used specifically for the protection of sun rights, it would seem that sufficient citizen participation and input has been provided for in the form of the City's established legislative process.

Economic Implications - It would appear that this alternative would impose the least adverse economic impact from the standpoint of future development within the City. Should existing regulations also prove to be satisfactory to assure the optimum energy "yield" from solar devices, this approach would seem to be the most acceptable with respect to economic considerations.

Administrative Implications - Since this alternative constitutes a continuation of the application of existing regulations, administration could proceed without difficulty. However, depending upon the citywide acceptance and use of solar energy devices, the number of requests to impose special height limitations (such as the "1-VL" limitation) could increase. This would depend, of course, on the specific properties involved and the demonstrable need to actually impose special owner's rights to sunlight.

B. Yard Regulations of the Planning and Zoning Code

In addition to building height and bulk controls, the long established front, side and rear yard requirements applying to the City's various zones have been an essential factor in promoting the "preservation of light and air" clause contained in the Zoning Code. As in the case of building height controls, numerous amendments to these yard requirements have been enacted over the years as specific situations have demanded.

C. Changes in Zoning and Height District Patterns

Under the approach it is assumed that existing zoning regulations provide the necessary "tools" to effectively deal with the problem at hand, but that it may be necessary to effectuate changes in the existing zoning/height district pattern to more adequately preserve future sunlight rights. Such changes would be accomplished in accordance with established legislative procedures and only after a comprehensive, citywide analysis of the problem.

Environmental Implications - The City's existing zoning pattern (as well as the Code itself) was established in 1946. Numerous individual changes have been effected in both the Code and zoning configuration since that time, to reflect current needs. For the most part, changes of zone and/or height districts have been approved only when in accord with adopted plans. To the extent that additional height district changes might prove to be necesary in order to preserve "rights to sunlight", it may be concluded that the goal of maintaining environmental integrity would be advanced. However, it would seem that such changes, solely to protect rights to sunlight, should be accomplished in accordance with broad policies, goals and objectives of an overall plan. As indicated above, this could be effected through appropriate modifications in the several components of the Environmental Element of the General Plan and by modifying Community Plans. Under this approach an environmental impact report would also probably be required.

Sociological Implications - This approach would probably be well received by environmental groups and those property owners beneficially affected, but could be opposed by the owners of "restricted" property, in the event that further limitations were to be placed on their development rights. The eventual degree of acceptance and use of solar energy by residents of the City would also be an important factor to consider in this regard.

Economic Implications - Depending on the magnitude of height restrictions which might be necessary throughout the entire City, this approach would, at best, probably result in some economic disadvantage to the ownrs of property wishing to maximize the development potential of their land. On the other hand, should the use of solar energy gain total acceptance and beome widely used throughout the entire City as a primary or augmentative source of energy, overall cost savings could accrue to all residents of the City.

Administrative Implications - Under this approach, actual administration of the revised zoning/height district patterns would not be too difficult. However, a substantial staff effort would undoubtedly be required to conduct a citywide analysis concerning the adequacy of existing zoning/height district configurations to preserve solar rights. It is conceded that more than 55 percent of the City's total land acreage (excluding streets) is devoted to low density residential development and that any potential problem would probably be confined to "areas of transition" where commercial or high density residential zones adjoin the more restrictive zones. However, a detailed analysis of these areas on a citywide basis would require a major staff commitment and considerable time to complete.

The initiation of proceeding for corrective zone or height district changes at precise locations identified by the study would then be required. Following normal legislative procedures, including due notice, public hearing, ordinance preparation and Council approval, official maps and records of the City would be modified accordingly.

2. SUBDIVISION CHANGES FOR SOLAR PROTECTION

The most important effect that subdivision regulations have on solar access is their influence on the way houses are finally orientated to the sun. Under current subdivision regulations the orientation of a building is dependent on how streets and lot lines are oriented. Building lines generally follow lot lines which generally must be perpendicular (side lot lines that is) to the street. So, if the street isn't oriented properly from the start, buildings will have poor orientation and access. There are two ways to get at this problem. First, by requiring proper street orientation, proper orientation of lots and buildings will follow. Second, by breaking down the interdependence of street, lot, and building orientation, good building orientation can be achieved despite poor street or lot orientation. This means providing for flexibility in platting lot lines and in building setbacks. In the Los Angeles area the optimal building orientation is with the long axis in an east-west direction or within 30 to 45 degrees of this east-west direction.

In addition, to diminish the dependence of lot orientation on street orientation, requirements for perpendicular lot lines can be dropped. If the angle of lot lines is unspecified, then the orientation of the street become much less important to how the lot and building are oriented.

A subdivision regulation could directly address building orientation, rather than specifying street or lot orientation for solar access. A performance standard requiring proper orientation of buildings in conjunction with flexible street, and lot layout provisions in subdivision regulations and flexible setback requirements in the zoning ordinance is a simple yet direct way to promote good orientation and access. A developer could choose whatever site design techniques that he/she wanted to meet the building orientation requirements.

Solar access, in many residential cases, is adequate under existing street width and setbacks spedifications and is probably more dependent on lot size and orientation than anything else.

Provisions that require open space to the north of tall buildings have the effect of buffering other buildings from shading. Most subdivision regulations have only general locational guidelines and leave the location of parks and open space to the developer. The regulations only specify the amount of land to be dedicated. Modifying for solar access protection means that a somewhat more specific locational guideline be included.

In a more general way, the concept of reserving and dedicating land for public use, may be applied to solar access. Developers could be required to reserve solar easements for lots in the subdivision as a condition of approval. This would involve requiring developers to attach to individual deeds, restrictions for the purpose of protecting solar access.

The State of California Solar Rights Act of 1978 (Assembly Bill 3250) which took effect on January 1, 1979 has modified the Subdivision Map Act and requires the review of proposed solar systems for a subdivision to conserve energy.

Section 66473.1 of the Government Code states: The design of a subdivision for which a tentative map is required pursuant to Section 66426 shall provide, to the extent feasible, for future passive or natural heating or cooling opportunities in the subdivision. The City Attorney: has advised the Planning Department to begin complying with Section 66426.1 to avoid possible judicial challenges of our subdivision and parcel map actions.

Therefore, commencing on July 2, 1979 all applicants are required to include with the tentative tract map materials Solar Energy Systems report prepared by a licensed engineer or solar systems expert or firm.

Examples of passive or natural heating and cooling opportunities in subdivision design, include design of lot size and configuration to permit orientation of a structure in an east-west alignment for southern exposure; as well as orientation of a structure to take advantage of shade or prevailing breezes.

In providing for future passive or natural heating/cooling opportunities in the design of a subdivision, consideration shall be given to local climate, to contour, to configuration of the parcel to be divided, and to other design and improvement requirements.

This provision of the law shall not result in reducing allowable densities or the percentage of a lot which may be occupied by a building or structure under applicable planning and zoning in force at the time the tentative map if filed.

Also, The State Law exempts condominium conversion projects from the Solar Energy requirement which consists of the subdivision of air space in an existing building when no new structures are added.

A. Site Plan Review Checklist

Another kind of document used in site plan review is a review checklist. Often this a summarization of design criteria found in a manual or ordinance. It can also be the only guideline that is used in the site plan review process. It is used by planners who review site plans as a quick reference and also can be useful to the developer. The current subdivision requirements for a solar report are under review in the City.

3. ZONE CODE AMENDMENTS FOR SOLAR ACCESS PROTECTION THROUGH BUFFER ZONE

The Municipal Code could be amended to provide for a protective "buffer area" wherever property classified for higher heights adjoins property classified for lower heights.

The objective of such a Code amendment would be to assure sunlight rights by prohibiting the construction of buildings to a height where shadows would be cast on adjoining properties in more restrictive zones. Under this approach, it is conceived that a progressive "step-down" in the permitted height of buildings would be established, extending from the street frontage of the less restrictive zone(s). Section 12.21.1 of the Planning and Zoning Code ("Height of Building and Structures") would probably be the appropriate section to amend. The precise distance within which the "buffer area" regulations would apply would depend in each case upon the zoning configuration of the properties involved.

Environmental Implication - In view of the objective of protecting a property owner's "rights to sunlight", the amendment may be justifiable, strictly from the standpoint of "improving the environment". If the Code were to be amended to impose this additional requirement on new construction, an Environmental Impact Report would probably be required.

Sociological Implications - In the case of those receiving the "benefits" of such an amendment, the effects would seem to be very positive. In fact, the justification for this type of amendment would seem to represent an extension of the rationale of property owners' groups and others who sought enactment of the special height limits now applying in the Code (e.g., the 1-L and 1-VL Height Districts). Conversely, however, the owners of property seeking to maximize the development potential of their land might view such a restriction in a directly opposite manner.

Administrative Implications - The ease with which such an amendment could be administered will depend, of course, on the precise language of the legislation. To facilitate administration of the regulations, one possibility might be to graphically indicate the extent of any "buffer area" and the absolute height limits permitted therein on district maps used by the Planning Department and Building and Safety Department. This method was used to facilitate administration of the special building height limitations applying in the vicinity of the two major airports within the City.

4. SOLAR EASEMENTS AND COVENANTS

Private agreements suitable for solar access protection include both restrictive covenants and easements. Both types of private agreements are familiar to developers and public officials and enjoy considerable use in the development process. They are especially attractive to homeowners because they offer a greater degree of citizen control over restrictions affecting development. However, they assure mutual willingness on the part of property owners. This flexibility is desirable because solar access protection often involves restricting activities on one lot to protect sunlight falling on an adjacent parcel. If this requirement can be worked out between lot owners or between a developer and a community, then solar access can be assured with minimal governmental involvement. The major concern on this alternative is the lack of public Planning and the eventual labyrinth of private agreements to further cloud title and bring problems to development.

A. Restrictive Covenant

A restrictive covenant is a contract between two or more persons, which may involve mutual promises of reciprocal benefits and burdens among consenting landowners.

The covenant or contract is restrictive because it involves one or more parties restricing their development choices which would otherwise be permitted under City Laws and Ordinances.

Restrictive covenants are often created by a developer at the time a subdivision or development is approved. These restrictions apply to lots within the development and are usually inserted into the deeds of all parcels to be sold or developed. Because they arise in the deeds of lot owners, they are also called "deed restrictions." when such covenants are inserted into the deeds they "run with the land," and apply to the parcel of property, as compared to applying only to a single individual who might own the property.

The developer might also insert a covenant in all deeds which creates a homeowners' association. The associations typically have a governing board which is empowered to enforce the other restrictive covenants. These associations, then, are similar to private governments. If thoughtfully established and properly governed, homeowners' associations can provide many assurances otherwise provided by public regulation but with greater flexibility.

The creation and enforcement of restrictive covenants sometimes is referred to as "private zoning." Each land owner within the area covered by the common plan has the power to enforce the restrictive covenants against all other property owners similarly affected. The general rule where the covenants coexist with public land-use regulations is that the more restrictive of the two will govern.

Covenants must also not violate public policy, and a covenant provision which creates a restriction against a local ordinance or policy to the contrary may be unenforceable. This relationship between covenants and public policy may be quite important where a community has solar energy and solar access policies in effect and covenants exist which would frustrate these public objectives.

Architectural standards are enforced in subdivisions across the nation for purpose's of maintaining property values and of perpetuating desirable neighborhood characteristics. These standards can be specified (1) in a covenant which might require, for example, that all residences conform to a particular architectural style; (2) by an architectural review board created by a covenant and empowered to grant variances or (3) by a homeowners' association to which all land owners in the subdivision are bound by covenant to join.

B. Easements

Another private agreement that can be used to protect solar access is the easement. Easements are interests in property that can be bought, sold, or transferred like the property itself. One of the most common examples is a utility easement, a right purchased or otherwise obtained by a utility company to run utility lines of some type across property. Applied to solar access protection, an easement would involve negotiating a right-of-way for the passage of sunlight across neighboring property.

Easements are recorded with a public agency, ususally the city clerk or other registrant of deeds. In many cases the easements attached to a piece of property must be considered in granting building and other development permits. Like covenants and deed retrictions easements can apply temporarily or permanently. A temporary easement applies to the owner of the land, a permanent easement applies to the land itself.

A solar easement is a negative easement. A regular easement allows somebody to enter or cross land belonging to someone else. A negative easement prevents the land owner from doing something that otherwise could be allowed, such as erecting a building on a lot which can cast a shadow across a solar collector.

A disadvantage of the easement approach to solar access is that it does not protect future solar access on a blanket basis. Easements generally will be negotiated individually, on a case by case basis. It is probably most appropriate in communities that do not want to regulate solar access comprehensively, but wish to provide some means for individuals to secure protection for their systems.

APPENDIX VI

CITY OF LOS ANGELES GENERAL PLAN - RELATION TO ENERGY

GENERAL PLANS

Concept Los Angeles

Adopted in 1974, this long-range design for Los Angeles is a part of the City's General Plan. Its key recommendations regarding energy are to concentrate new development into urban centers and to link these centers with improved mass transit systems. This urban form permits less reliance on the automobile for transit and a greater incentive for public transit because of greater density in centers. Employment centers, education, entertainment and residences would all be located closer together in centers, thereby minimizing travel requirements. Transportation within centers would be possible on elevated pedways and by internal public transit systems. Zone rollbacks outside of centers would encourage the future development of high-density areas. The Concept Plan is being implemented through the adoption of the City's various Community and Technical Plans.

Citywide Plan This document, adopted in 1974, is the 20-year long-range plan to guide overall development in the City. A greater level of detail is provided than in the Concept Plan. Relevant policies related to energy include:

- Plans and programs be encouraged which increase the efficiency of and minimize energy utilization by residential, commercial and industrial users.

- The City's highway and freeway system be improved as a major component of the City's integrated transportation system. Better use of the highways and freeways is to be achieved through advanced traffic control systems and exclusive lanes for buses and car pools.

- Within the core of principal centers, pedestrian and non-pedestrian traffic be separated.

- Energy systems be considered that will minimize pollution from all publicly owned vehicles.

- Experimenting with new transit routing alignments to reduce transfers and encourage patronage.

- Seek immediate funding for additional bus service between suburbs and centers to encourage the use of buses for daily activities and to decrease the need for long distance commuter travel.

Community Plans The 35 separate community plans that cover the City of Los Angeles in detail are currently being adopted or implemented. Twenty-seven plans are adopted. The remaining plans are either awaiting approval by City Council or are being updated. Within all community plans are certain programs related to energy:

- Development in each district is to be coordinated with other parts of the City reinforcing the Centers Concept. Growth will be controlled, thereby mitigating many adverse environmental impacts, including wasted energy.

- Reduce the zoning capacity and conserve open space; examples include population capacity reductions from 370,000 to 236,000 in the Wilshire Plan and population capacity reductions of 378,000 to 211,000 in the Southeast Plan.

- Encourage the expansion and improvement of public transportation services including rail transit, mini-buses and car pooling.

- Incorporate the Highways and Freeways Element in each district plan.

Conservation Plan Adopted in 1973, the Plan includes the following references to energy:

- Revise building codes to require better insulation in public and private structures, careful attention to sunlight orientation, and better control of internal heat sources.

- Establish an advisory committee composed of architects, building contractors, Department of Building and Safety personnel and utility personnel, both public and private, for the purpose of determining standards of energy utilization.

- Institute a study program to determine the maximum energy level for each community area, similar to maximum density or commercial/industrial floor space concepts.

- Consider an ordinance reducing the use of lighting within high-rise buildings for the purpose of conserving the amount of energy required to cool office buildings.

- Seek the extension and improvement of mass transportation facilities.

- Seek immediate funding for additional buses as an interim measure until construction on a mass rapid transit system can begin.

- Seek funding for the construction of peripheral parking facilities to serve high-intensity Centers.

- Encourage the implementation of a work week which will disperse peak concentration of traffic.

- Urge continuation of feasibility studies on completely switching present fuel utilization: automobiles to utilize gaseous fuels and industries and power plants to burn non-leaded gasoline.

- Continue studies on the effect Daylight Savings Time has on energy usage and air pollution during summer months.

- Study the feasibility of applying controls such as Conditional Use on high-rise office and residential developments or other large-scale projects.

    - Consider limiting the amount of energy used for advertising billboards and signs.

    - Encourage the use of bicycles for transportation purposes as well as recreational use by providing safe bikeways with convenient and secure bicycle parking facilities at major buildings.

PLANNING ACTIONS (ONGOING)

1. Zoning Adjustments The City presently has zoning capacity far in excess of the 1990 population projection. The City has been reducing the excess zoning by the gradual implementation of zoning rollbacks consistent with adopted community plans. The goal is to achieve consistency between community and concept plan designations and zoning.

   The goal of a maximum zoning capacity of about 4.1 million, down from a theoretical maximum of 10 million in 1972, could help redirect excess growth away from fringe areas and consequently increase energy efficiency. Certain rollbacks would also reduce vehicle-miles traveled and offer incentives to develop a mass transit system by encouraging the development of high-density centers. A more rational land use pattern could have a major impact on reducing energy inefficiency.

2. Specific Plans Certain localized areas within a Community Plan require special planning studies because of unique problems such as traffic or density. At present, the City has completed work on three specific plans but work is anticipated in another 25 target areas. Specific plans provide detailed standards and guidelines in the form of ordinances which

SOLAR

a. Solar Hot Water Heaters in Homes of Department of Water and Power Customers (Department of Water and Power - ongoing) The DWP will place solar hot water heaters in the homes of 100 of its customers who are paying high electricity bills which result from the use of electric hot water heaters. Contracts are now being drawn. Volunteer customers will be selected, and they will shop for heaters on the market. The customers must select those approved by City Building and Safety Department. DWP will charge a predetermined amount on the electric bills of these customers. The charge will be less than that of electricity for water heating. DWP will monitor the performance of the systems.

b. Solar Police Station (Bureau of Public Buildings - ongoing) The largest solar project within the City will be at Wilshire Division Police Station. It will have complete solar space heating and hot water. It will employ collectors mounted on a special assigned parking lot canopy. The project will be funded primarily by a grant from the Department of Energy. A design contract was recently signed with one of area's small solar energy businessmen who helped the City win the grant.

c. Solar Electric Power Plant (Department of Water and Power - ongoing) An agreement was signed for the world's first commercial (10 megawatts) solar electric power plant. The Los Angeles Department of Water and Power will work with the Southern California Edison and the Federal Department of Energy in this effort. It will be built near Barstow and it will generate electricity by the early 1980's. It was designed by McDonnell Douglas.

d. Solar Fire Station (Bureau of Public Buildings - ongoing) Construction has begun on the first of several new City fire stations that will be equipped with solar water heaters. The first will be in East Los Angeles. All new stations will be built with plumbing that will allow retrofit of solar later, should the first system prove successful.

e. Solar Energy for City Office Buildings (Bureau of Public Buildings - ongoing) The new headquarters of the Hyperion Sewage Treatment plant will be equipped with a solar hot water heater. It is being installed by local businessmen and is now under construction.

f. Optimum Energy House This project is being built by students of the Los Angeles Trade Technical across from the Convention Center. It will feature solar-assisted heat pumps and many other ways to save energy in a cost effective fashion.

g. Solar Low-Income Housing (Community Redevelopment Agency - ongoing) This project is being built by the Pico Union Community Development Corporation. The townhouses should be completed by mid-1979.

h. Solar Swimming Pool (Bureau of Public Buildings - ongoing) This project in Echo Park has been approved by City Council. Other swimming pool projects will be scheduled for retrofit as funding becomes available.

i. Solar City Power Plant (Department of Water and Power - ongoing) This facility will convert sunlight directly into electricity without first converting it to steam. The Federal Department of Energy has granted $220,000 to the Department of Water and Power for design of photovoltaic (solar) cells system to supply electrical energy at the Valley Steam Plant.

j. Consumer Assistance on Solar Information (study) City help will be provided as a result of a survey showing that a small but significant proportion of solar permit holders have had problems with their systems. A complete booklet of information and advise is being prepared.

k. Sun Access and Use (City Planning - ongoing) Sun access must be protected in order to develop solar energy. The Planning Department produced a study for the Solar City Committee on the "Right To Sunlight" in Los Angeles. The Solar Committee meetings have been the earliest forum for many other emerging issues in solar energy, such as financing, utility leasing programs and builders' attitudes toward solar energy.

l. Solar Energy Code for City (Department of Building and Safety - ongoing) The Solar City Committee worked with the Building and Safety Department in bringing together all sections of the City Building Code relevant to solar energy into a single document. It is also working on streamlining the handling of permits and testing new systems. The Department's testing lab has tested and approved roughly 20 solar devices and systems and the lab's approval for safety and durability is sought by industry. A "solar hot line" has also been set up to assist individuals and businessmen with permit and testing problems.

CITY FACILITIES

a. New Buildings Energy Efficiency (Bureau of Public Buildings - ongoing study) A proposal was directed to the Mayor to establish energy efficiency as the top priority in the design and construction of new City buildings. This was done as an administrative action within the Department of Public Works by amendment to the "Architect's Instruction Book" in January 1976.

As guidelines for staff designers of City facilities, the City Architect has established minimum design criteria. Since December 1975, about ten new buildings have had or are in the process of having energy efficiency calculations performed while awaiting the enactment of Title 24, the State mandatory standards for nonresidential buildings.

b. Heating and Cooling (Bureau of Public Buildings - ongoing) Thermostat settings in public buildings for heating and cooling were adjusted for conservation in February, 1974. Building operators are maintaining cooling within a range of 76-78 degrees and heating at 64-66 degrees.

As appropriate for the varying mechanical systems of City buildings, adjustments have been made to maximize the use of outside air instead of refrigeration for cooling, and the City Hall East heating/cooling/ventilating system is operated to prevent simultaneous heating and cooling, a characteristic of many modern buildings.

c. New Conservation Lighting Standards (Bureau of Public Buildings - ongoing) Specific standards for lighting that were consistent with Federal conservation guidelines. The lighting standards were adopted after discussions with the Interdepartmental Committee on Energy Conservation and with representatives of the City Safety Inspector, with respect to possible conflict between safety and conservation for lighting.

d. New Lighting Standards (Bureau of Public Buildings - ongoing) New City requirements (established in 1974) have been applied to all new municipal buildings and renovations, and the Bureau has been systematically reducing lighting levels to these standards. Reduction from initial design levels of about 40 percent has been accomplished in City Hall East. Work is about 70 percent complete at this time. Overall lighting reduction in the Civic Center complex is about 25 percent from design levels. In addition, the Bureau has carried on a regular program of replacing inefficient incandescent light fixtures with energy-saving fluorescent fixtures.

e. Street Lighting System (Bureau of Street Lighting - ongoing) This system accounts for the largest single use of energy among the Council-controlled departments. This is the result of the system's size and the requirement for effective illumination for public safety.

Energy and Cost Conservation Program The two primary means of securing energy savings in street lighting operations are in (1) increasing the efficiency of the equipment to use less electricity for the light generated or (2) de-activating a portion of the lights. The Bureau of Street Lighting has begun implementation of the energy and cost conservation program as approved by the City Council. This program retrofits and modifies incandescent street lights with more efficient equipment to secure savings in both energy and cost of operation.

New Street Lighting Systems Every year the total inventory of street lighting installations (physical plant) increases about 2 percent or about 4,000 installations as a result of various types of projects, including assessment lighting districts and large housing tract developments. It has been normal practice in the past to install mercury vapor units. The City's practice now is to install more energy-efficient lamps, usually high-pressure sodium, where practical and feasible. Energy savings amount to 30-40 percent. This is an ongoing policy with no completion date other than when every street within the City is properly lighted.

f. Flashing of Traffic Signals (Department of Traffic - ongoing) The Department has formulated a plan for operation of traffic signals in a flashing mode during late night hours at selected lower traffic locations throughout the City. Operation of an initial group of 81 signals in this flashing mode will result in electrical energy savings. This plan will be implemented as rapidly as equipment changes can be scheduled.

g. Automatic Light Shut-Off (Department of Water and Power - ongoing) In addition to use of DWP building conservation techniques, a DWP innovation is automatic shut-off of almost all office lights after business hours to insure lights are not burning in vacant offices.

h. Computerized Power Allocation (Department of Water and Power - ongoing) The DWP general office building is one of eleven downtown office buildings connected to a central computer network which is receiving, recording, and charting energy and load patterns in a $540,000 pilot program initiated last year by ERDA. Soon, building engineers in the eleven buildings will begin receiving and accepting instructions from the computer program to reduce power consumption at peak periods, reducing demand for the burning of fossil fuels for electricity for each building and system load for DWP.

HCD-FUNDED PROGRAMS AND PROJECTS

The greatest direct influence on housing and thus residential energy conservation is through the City's Community Development Department (CDD).

The Community Development Department facilitates the City's participation in Federally assisted housing and socioeconomic programs. The primary function is to coordinate and assimilate the information of various City Departments and other agencies for the Housing and Community Development (HCD) Program; initiate and maintain the Citizen Advisory Committees in each project area in which a Housing and Urban Development (HUD) assisted program is in process; and to propose and monitor housing programs and all related community development activities, such as recreation and social, economic, and environmental considerations. As such, CDD is responsible for the identification and monitoring of those physical, economic, and social forces which contribute to obsolescence and blight in the City. In addition, the Community Development Department is responsible for the identification of "need", overall planning, program monitoring, and evaluation necessary for the City's yearly federal grant request. Responsibility for the preparation of the Housing and Community Development (HCD) grant application and the Housing Assistant Plan (HAP) rest with the Community Development Department.

a. Housing Division of Community Development Department - The Housing Division has the responsibility for the initiation and administration of housing programs for the City, including development of the City's Housing and Community Development Application. Based on studies supplied by various City agencies, the Housing Division develops housing program packages to meet identified needs. The housing programs become part of the City's Housing Assistance Plan required each year under the HCD application. The Housing Division also recommends funding and implementation packages for these programs.

   The Housing Division of Community Development offers unique opportunities for energy demonstration projects concurrent with ongoing housing programs and implementation packages. In addition, energy programs in the low- or moderate-income target areas would affect those least able to cope with energy cost escalations

b. Community Development Programs - A partial listing of programs that could be reviewed for potential energy involvement include:

The HOME Program - A single-family rehabilitation program which is located in areas containing low-income, owner-occupied housing in need of major rehabilitation. The program provides interest rate subsidies, technical and architectural assistance to the homeowner, and capital improvements to upgrade the overall appearance of the neighborhood. By providing interest rate subsidies, the City is able to provide leverage a large amount of private rehabilitation assistance with a relatively small amount of HCDBG funding. In the Fifth Program Year, thirteen areas will have a HOME Program. Previously identified areas include: Hollywood, Boyle Heights, and Crenshaw (Leimert/Exposition and West Adams). New areas are: Highland Park, El Sereno, San Pedro, Sylmar, Sun Valley, Watts, Echo Park, North Hollywood and Cypress Park.

There is a need for new space heating systems, insulation, weather stripping, water tank insulation and attic turbines.

Hardship Emergency Loan Program (HELP) - In the fifth program year, the HELP Program will have a new focus. The Housing Division proposes to change the HELP emphasis to assist multi-family dwelling units and renters. Often, the worst housing conditions in the City are found in small multi-family structures with rental occupants. Many of these structures do not meet the housing code. However, no financial assistance has previously been available to aid these units.

Hollywood Neighborhood Strategy Area (NSA) - The City of Los Angeles has proposed to the Department of Housing and Urban Development (HUD) that Hollywood be designated as a special Neighborhood Strategy Area (NSA). Section 8 rehabilitation assistance has been requested to work in conjunction with the ongoing HOME Program, California Housing Finance Agency (CHFA) loans, and other rehabilitation assistance. Los Angeles will receive NSA assistance, for a total of $90 million in housing subsidies to be provided to Hollywood residents. There is a potential for new heating systems, insulation and weather stripping.

Multi-Family Urban Homesteading Program - This program will allow low-income homesteaders to repair deteriorated multi-family structures with the CETA program paying for their labor. The homesteaders may then become owner-occupants through a Section 8 Demonstration Program. This program will work in some of the most deteriorated housing areas in the City and will achieve one of our primary goals, that of producing newly rehabilitated low-income housing in Los Angeles. In addition, CETA labor could provide insulation and weather stripping.

Handyman Program - The Handyman Program is a continuation of a fourth year program which combines CETA labor assistance with HCDBG material subsidies to provide paint-up, security, and minor repair services for low-income and elderly homeowner-occupants. This has been one of the most successful HCDBG programs. In each program area, 100 dwelling units are repaired and painted. This significantly improves the neighborhood. Twenty-two separate program areas have been identified as candidates for the Handyman Program. A total of 2,200 dwelling units will be rehabilitated through Handyman funding. Insulation, weather stripping, etc., would be possibilities.

Housing Production - The City Council has instructed the Community Development Department (CDD) to evaluate program alternatives to increase housing production of low-cost housing units within the City. The Housing Division is attempting to identify the program which will provide the best leverage for the HCDBG budget. An analysis is now being made by the Housing Authority and the CRA, at the direction of the Housing Grants and Community Development Committee of the City Council, to evaluate alternatives, including move-on housing, industrialized housing, homeowner equity participation, and land transfer funds, to determine which program will provide the best alternatives for the Housing Production budget. HUD has required that the City make a sincere effort in producing low-cost family and elderly housing across the City. To carry out this instruction, the Housing Production Program has been added to the Housing Division's budget. Any low-cost housing would need maximum energy efficiency due to the coming unaffordability of energy.

OTHER HOUSING-RELATED AGENCIES

a. Community Redevelopment Agency (CRA) - This Agency is responsibile for administering the City urban redevelopment programs. This includes both Redevelopment Projects and Neighborhood Conservation Projects. The former involves extensive housing and community improvements in blighted areas, while the latter will concentrate on more limited improvements in transitional areas of the City. Examples of Redevelopment Areas are: Bunker Hill, Hoover, Watts, Beacon Street, Normandie 5, Little Tokyo, Pico Union, Monterey Hills, and Wilmington. CRA activities within redevelopment areas include project planning, acquisition, rehabilitation, public improvements, and sale or lease of property. In the designation of redevelopment survey areas, the Agency serves in a joint role with the City Planning Department. Proposed Neighborhood Conservation areas under HCDA funding include: Venice, West Adams, Atwater, Highland Park, Van Nuys and North Hollywood. Neighborhood Conservation efforts include rehabilitation, home improvement counseling, public improvements and loan insurance. Energy planning consideration is of prime importance to any CRA activity.

b. City Housing Authority (CHA) - The Housing Authority has the responsibility to provide decent, safe, and sanitary housing at a rental rate the low-income person can afford. This is being accomplished by maintaining low-rent housing developments and Leased Housing Units. The Authority will be developing additional housing under the HCD Section 8 Program. Persons displaced by CRA projects receive first priority from the Housing Authority if units are available. The Housing Authority and the Community Redevelopment Agency are jointly cooperating in developing and managing new housing units for low- and low-moderate-income tenants in redevelopment areas. Encouragement of more energy-efficient housing is furthered by this agency.

c. Community Design Center (CDC) - The CDC has been funded for the past two years to provide technical and architectural assistance as requested within HOME Program areas. The CDC staff is funded only partially out of Block Grant dollars, with the remainder of their budget provided through CDTA and VISTA grants. The CDC works with HCDBG dollars in low-income communities to provide low-income homeowners with architectural assistance for needed home improvements. Energy conservation is stressed in CDC programs.

d. Economic Development Strategy - Three entities within the City of Los Angeles now operate complementary programs designed to strengthen the economic base of the City and to preserve and expand the City's supply of affordable housing. These entities are the Community Redevelopment Agency, the Community Development Department, and the Mayor's Office of Economic Development (CEDO). The coordination of their activities provides unique opportunities within the City of Los Angeles to attract private investment in commercial, industrial and residential development; retain and expand local employment opportunities; prevent further loss of industrial and commercial enterprises from the area; bolster the City's tax base; stabilize declining neighborhoods; and revitalize those which have already declined by stimulating investing in deteriorated and abandoned housing. In conjunction with the City's Comprehensive Community Energy Management Plan process, the City anticipates becoming the hub of the energy and/or solar industry in the State.

STATE-MANDATED PROGRAMS

Residential Building Standards

Residential building standards to reduce wasteful, inefficient, unnecessary or uneconomical uses of energy are required to be adopted by the State Energy Commission in the Warren-Alquist Energy Resources Conservation and Development Act of 1974. The Energy Commission first adopted residential insulation standards in 1975. These standards took effect December 23, 1976. The regulations described below are amendments of, and additions to, the previously adopted standards. These amendments and additions have been adopted.

The State is considering further amendments to the residential building standards which would set performance standards for energy consumption for the entire structure in addition to the component standards which appear in the present standards. These new amendments would not change the amount of energy required to be conserved but would encourage more flexibility in design and construction to get the required results. These amendments are scheduled to be adopted in July of 1978 and become effective July 1979.

The State residential building standards are required to be adopted and enforced as part of local building codes. Local jurisdictions can adopt local standards which are stricter than those of the State. In addition, local jurisdictions may be able to adopt standards that are more flexible than the State standards if it can be shown that local conditions make implementation of the State standards unreasonable.

The major provisions of the standards are:

a. The standards apply to all new residential buildings for which applications for building permits are required. This includes not only new construction but also additions to existing buildings.

b. Because California has many different climates, the amount of insulation required in ceilings and walls will vary with the building's geographical location in terms of its number of degree days. For any one day, when mean daily temperature is different than 65 degrees Fahrenheit, there are as many degree days as there are degrees difference in temperature between the mean temperature for the day and 65 degrees Fahrenheit. The number of annual degree days in California varies from a low of 1,060 in Imperial (on the low desert) to a high in Truckee (near Lake Tahoe) of 8,208. In the San Diego Region the number of annual degree days varies considerably also. Julian has 4,085 annual degree days. Parts of the City of San Diego have 1,492 annual degree days. (See Figure 2, page 12.) The standards require the use of R-19 ceiling insulation in areas of the San Diego Region which have 3,000 or fewer annual degree days. Additional ceiling insulation is required in areas that have over 3,000 degree days. Additional wall insulation is required when degree days exceed 3,500.

c. Floor insulation is required for areas with more than 3,000 degree days. However, it may be omitted from areas in the house above unheated crawl spaces or unheated basements if the crawl space is equipped with operable louvers, the foundation wall is insulated, and a vapor barrier is installed.

d. All glazing in buildings which are mechanically cooled or located in areas with summer design temperatures in excess of 85 degrees Fahrenheit (for example, Vista, La Mesa, and Escondido) will be required to be shaded to protect the building from direct solar exposure in summer. Glazing is defined as all transparent or translucent materials in exterior openings. New glazing standards are provided to encourage the use of passive solar-assisted heating. Double glazing is required in areas in which annual degree days exceed 3,000.

e. The proposed standards prescribe maximum levels of thermal conductivity for doors.

f. For residential heating systems utilizing depletable energy sources, electric resistance cannot be selected unless the life-cycle cost of all alternative systems (gas, heat pump and solar climate control systems) is higher than for electric resistance. If the dwelling is to be mechanically cooled, the costs associated with the cooling system shall be included in the life-cycle cost analysis.

g. Electric resistance heating will no longer be allowed to heat swimming pools.

h. Electric resistance water heating systems may not be used unless the life-cycle cost of all alternate energy systems exceeds the life-cycle cost of the electric system.

i. The standards also cover provisions for pipe insulation, ducts, heating equipment sizing and efficiencies, exhaust fan back-draft dampers and vapor barriers.

The City Department of Building and Safety is presently enforcing the State standards.

Mayor's Office

Mark Braly, Energy Coordinator

Warren Williams, Assistant to the Energy Coordinator

City Attorney's Office

Burt Pines, City Attorney
Jan Chatten-Brown, Assistant City Attorney

Department of City Planning

Calvin S. Hamilton, Director
Frank P. Lombardi, Executive Officer
Glenn Blossom, City Planning Officer

Citywide Planning and Development Division

Glenn O. Johnson, Chief
Charles Montgomery, Project Manager
Albert Landini, Former Project Manager
Dave Gay, Project Coordinator
Bob Keen, Former Staff Researcher
Linda Ford McCaffrey, Editor

Graphics Section

Gene Wolfe, Graphics Supervisor
William May, Cartographer
Phil Watson, Unit Head, Publications
Rey Hernandez, Data Illustrator

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Peter Pollock

16. Abstract (Limit: 200 words)

In this report, the feasibility of translating the concept of solar envelopes into zoning techniques was examined by the City of Los Angeles through the Mayor's Energy Office, the City Planning Department and the City Attorney's Office. They concluded that envelope zoning is a fair and consistent method of guaranteeing solar access, but problems of complexity and uncertainty may limit its usefulness. Envelope zoning may be inappropriate for the development of high density "centers" and for more restrictive community plans. Aids or tools to administer envelope zoning need to be developed. Finally, some combination of approaches, including publicly recorded easements, subdivision approval and envelope zoning, need to be adopted to encourage solar use in cities.

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